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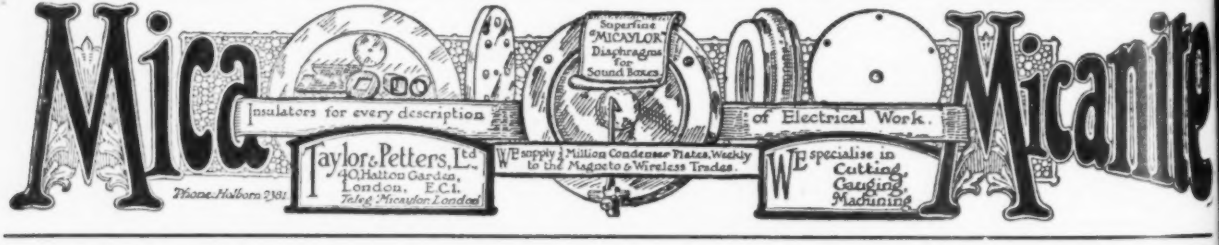
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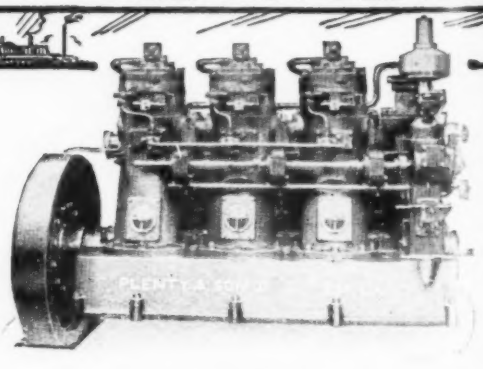

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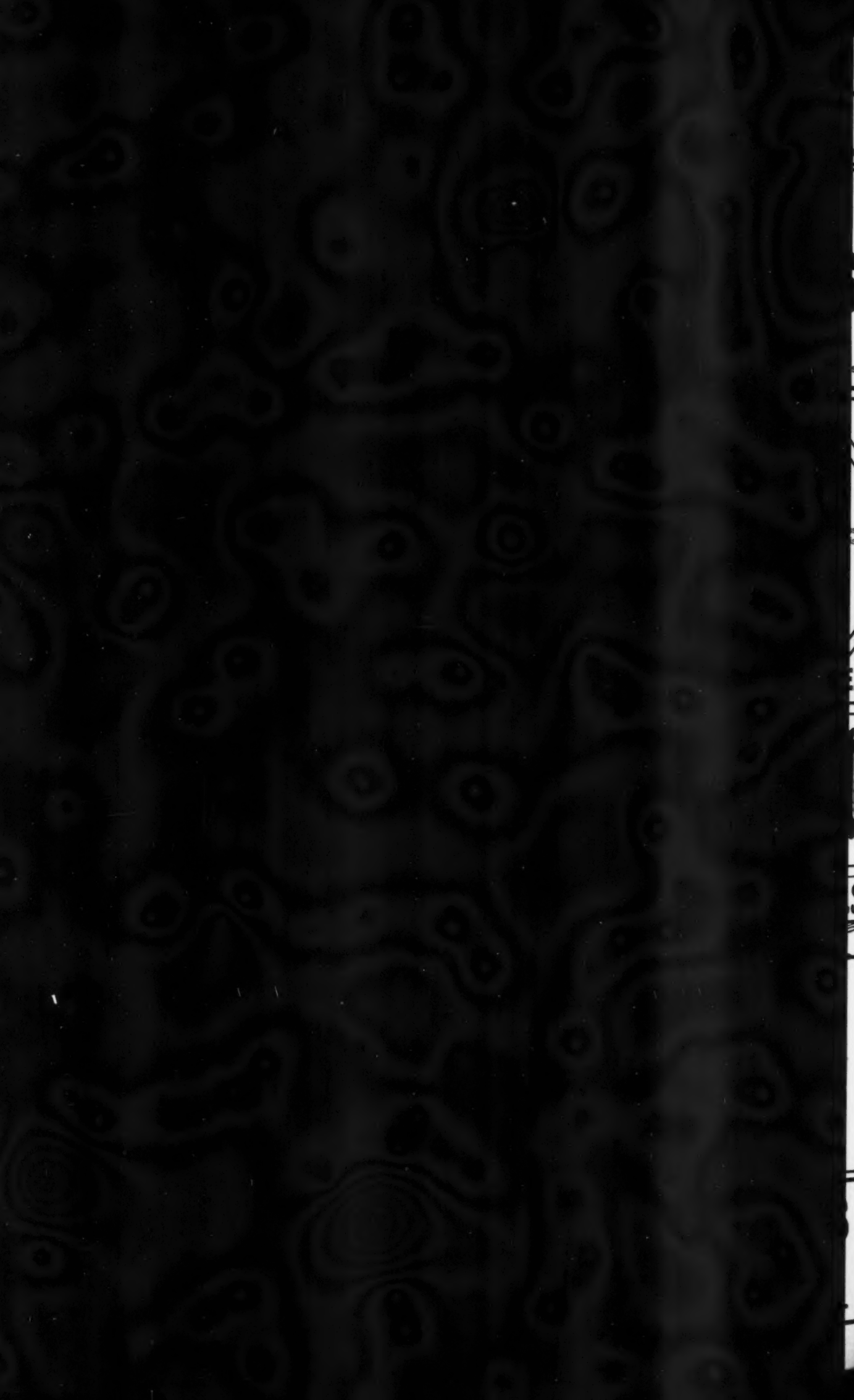

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The Electricity Supply Problem.

A CLOSE examination of the debate in the House of Commons on May 21st reveals the fact that a number of theories with regard to electricity supply are cherished by various speakers, which augur ill to the industry unless, as we hope, the Government is well advised and steers a wise and prudent course between the rocks and shoals of political catchwords. One view that is confidently held is that the secret of a "cheap and general supply" lies in linking-up power stations, but the holders have different ideas as to how their panacea will operate. Mr. Lloyd George said that Germany, by "improving the interchange," was able to use her machinery by day as well as night; Mr. P. Snowden explained that if one station was overloaded and another underloaded, "intercommunication" would get over the difficulty; and Sir Robert Horne, whilst less enthusiastic, thought that interlinking might improve the load factor and cheapen production.

What Mr. Lloyd George meant we do not know; it is certain that if our factories could obtain sufficient orders, and if the trade unions would agree to night-work on reasonable terms, the generating plant that is adequate for their present daylight needs would be equally capable of driving their machinery at night. The obstacles here are not electrical in origin. As for Mr. Snowden's theory, it would serve if the load curves of the coupled stations were more or less complementary; but if, as usually happens, they are similar, then interlinking simply means the substitution of transmission mains for stand-by plant. That may be sound procedure, in view of the rapid obsolescence of generating plant—provided that the obsolescence of cables proceeds less rapidly than that of station plant, which is probably the fact—but whether the supply will be cheapened by such interlinking depends upon the cost, which may easily exceed that of the equivalent stand-by plant. Sir Robert Horne, while demurring to the huge "super-station," approved of large stations supplying energy in bulk to small and uneconomical stations which would become distributing centres, the former being "linked up in some fashion"; but the load factor would not be improved as he suggested, unless the load curves were appreciably different.

It is well to face the facts and avoid unjustifiable optimism. It is noteworthy that the Electricity Commissioners themselves have been guarded in their references to "cheap" supply. They have indicated the importance, which cannot be doubted, of extending the supply of electricity to the small towns and villages and the rural population generally—a proceeding which, as

we have reported, in France has resulted in an extraordinarily rapid development of the uses of electricity. For the rest, they showed in their last report that three-quarters of the population of this country had already, or in immediate prospect, a general supply of electricity.

It is evident that the possible cheapening of electrical energy due to improved thermal efficiency is limited. About 98.5 per cent. of the total output is already derived from stations which show an average consumption of 2.6 lb. per kWh, and the Electricity Commissioners regard 2 lb. as a reasonable average figure for "modern and efficient stations." The best result for the year (Barton) was 1.48 lb., and there is no immediate prospect of beating that figure. Hence, the utmost that we can expect from improved thermal efficiency is to save, say, 1 lb. of coal per kWh, worth about 0.1d. Hence it is absurd to maintain that the possible cheapening of electrical energy by economy of fuel can appreciably affect our ability to compete with foreign nations.

It is true that a reduction in the consumption of fuel per kWh implies a reduction in cost of plant and in capital charges, but the greater refinements required to effect it somewhat discount this advantage, and the concentration of plant inevitably involves increased expenditure on mains.

It seems to us, as we have indicated on previous occasions, that the real crux of the situation is heavy capital charges, which are the bane of the electricity supply industry; their effect can be mitigated in no other way than by improving the load factor and thus distributing them over a greater area. Merely increasing output will not serve unless the load factor is simultaneously increased, and therefore the most important problem before the industry is how to attain this object. The point was admirably put before the House of Commons in the recent debate by Lieut.-Colonel Moore-Brabazon, Parliamentary Secretary to the Ministry of Transport, who pointed out that "it is only through pushing the sales that you can keep your load factor high and get good returns," and said in words that might almost have been taken from our own pages, that "we take the current to the house and then we leave it to the man to carry on." In the domestic load lies the solution, at least in part, of the load factor problem. The electrification of the railways is another most effective method of filling up the valleys in the load curve, and the use of electricity in agriculture is a third, no doubt a minor but still a useful, addition to the day load. Incidentally, the last mentioned, by increasing food production, would diminish importation and stabilise the population, besides developing one of our most valuable natural resources—the fertile soil. The manufacture of artificial fertilisers by electrical means, stimulated by more intensive agriculture, could also be utilised as a controllable day-load, and thus further benefit the load factor.

The Allocation of Electricity Profits.

THERE is general agreement within the electricity supply industry that the profits from an undertaking should not be used to any large extent for rate relief, but local authorities sometimes succumb to the temptation to stand well with the public by distributing too substantial a proportion of the declared "profits." Although, presumably, the consumers benefit by this to a certain extent, as ratepayers, they are are also relieving non-consumers of part of their obligations, always assuming that the undertaking has not made a call upon the rates, or has already made good any grants received in previous years.

There is another method of disposing of profits which, while not so obviously unfair to the consumers, may cause them to pay more for their electricity than they would otherwise have to do. This is the charging of works of a capital nature to revenue. As a method of strengthening the financial position of an undertaking, the advantage of thus disposing of the necessity for raising further capital is unquestionable. On the other hand, the payment of interest on capital and its redemption can be spread over the life of the assets which it represents, and the process is a less severe one, from the consumers' point of view, than the allocation of the sum from revenue all at once. Like many another matter, this operates to the advantage of future consumers at the expense of the present ones, but the latter are prone to ask, in the classic phrase, "What has posterity done for us?"

In a recent report to his Electricity Committee, Mr. L. L. Robinson, the Hackney borough electrical engineer, not only made a protest against the contribution of a large proportion of the surplus to rate relief, but also raised an interesting point regarding the "life" of generating plant, which intensifies the problem. He showed that it was often sound policy to scrap machines before the end of the life allotted them in terms of loan repayment. Thus a generating set might, so to speak, be cut off in the flower of its youth, to make room for more efficient plant, leaving unpaid a large proportion of the money borrowed for its purchase. Yet a further point made by Mr. Robinson was the burden represented by the high prices of plant bought three or four years ago. He showed that a 10,000-kW set which was installed last year cost £67,650, whereas a similar equipment to be delivered next year might now be ordered for £34,955. These considerations give force to Mr. Robinson's contention that: "Obviously the capitalisation of the undertaking must be handled with the greatest care in the near future, in order to diminish the burden of the present position as much as possible, and everything that is possible must be done to increase capacity at the minimum cost per kW consistent with efficiency, and our surplus funds should be kept in the business until the heavy cost of immediately post-war plant can be written down to present-day value."

The Electricity Commissioners, while more or less powerless in the matter of rate relief, have definitely set their faces against the use of revenue for capital purposes, unless this is specifically permitted by Act or Order, and while lower and lower prices for energy are so vitally necessary, we think that their attitude is fully justified.

Definitive Units.

AT the International Mathematical Congress held in Toronto last year, "Definitive Units" were proposed for universal use.

The definitive system of units was set out in detail and the aim declared as follows:—"The natural ultimate goal is the universal use of these units for all purposes. In the attempt to extend the application of metric units in the United States the meter-stere-kilogram, rather than the meter-liter gram, should form the basis for legislation, in order to give definitive units their proper legalised status and to secure to the full the advantages of a comprehensive system consistently interrelated with the legalised international electrical units. The gradual discarding of CGS and other redundant units would inevitably follow."

Now it is natural that every group of workers should desire to employ the units most convenient for their work, and indeed nothing short of oppressive legislation will prevent their doing so. The mind deals most easily with small numbers. If the gradations to be dealt with are few, the numbers preferred may range from 1 to 12; if more numerous, from 1 to 100; hence the prevalence of *percentage*. Consequently professions and trades that deal constantly with limited measurements usually invent special scales in which to express them numerically; this is exemplified when you buy boots, guns, hydrometers, wire-gauges, or what-not. Mathematicians who deal with infinite gradations and wish to apply them to every branch of human knowledge would like a set of units universally applicable, and they are quite right to devise such a system: but when they expect their system to come into general use, for all purposes, they invite disappointment. It is extremely unlikely that, in the absence of official coer-

cion, many individuals would find it advantageous to change over.

No doubt it is exasperating to a mathematician to find the data he happens to be engaged upon presented in illogical units; but he must console himself with the reflection that they are probably presented in the units most convenient to the persons who provide the data, that the use of such units probably saved time and money, and perhaps, if other units had been employed, the data would not have been so accurate or complete. In any case it is a hardship on any worker to scrap the mental *capital* he has accumulated, in the form of habits of mind, which facilitate his manipulations of just these units, and one which he is not likely to undergo if he can help it.

Unfair Competition.

In the course of a speech recently delivered before the National Federation of Iron and Steel Manufacturers, Mr. John Hodge, president of the Workers' Confederation, stressed once more the inconsistency of an attitude which, while it imposed upon those wishing to be Government contractors a "Fair Wages" stipulation, allowed Continental manufacturers to come into this country with goods produced under worse conditions and for lower wages than obtained here. He strongly asseverated that they ought to stop products coming into this country which were made under conditions which they would not allow a British manufacturer to adopt in competition. With reference to the price competition of Belgium in this particular industry—British electrical and other manufacturers who have to secure their raw material abroad have considerable dealings with Belgium we believe—Mr. Hodge showed that the Belgian iron and steel works were advantaged against the similar industry in England because the Belgian Government sold coal to its manufacturers at ten shillings per ton as compared to double that figure paid by British works. He held Reparation coal to be largely responsible for the present situation in our iron and steel industries.

Sir Philip Cunliffe-Lister, of the Department of Overseas Trade, speaking on the same occasion, said that at no earlier period in the history of the industry had the imports of iron and steel reached so high a level as in the first four months of the present year. Mr. A. O. Peech, the chairman at the function, remarked that idle workers must have cost the country during the past year a sum which represented a subsidy of approximately £2 18s. on every ton of imported steel. The President of the Association said that the whole of the industry would unitedly be able to frame a proposition to lay before the Government regarding the situation and the need for temporary assistance.

Popular Industrial Films.

If the kinema is a potent power for evil, as many hold, there is no doubt that its potentialities in the opposite direction are also great in spite of the perversity of human nature. Already it is used in a subtle manner to impress upon receptive minds ideas which benefit numerous commercial interests, sometimes to the advantage of the recipient also. The educational film is now a normal, though often negligible, component of the ordinary kinema programme, and the Federation of British Industries has taken a wise step in producing films of this kind. We refer in our "Business Notes" to the first display, in the nature of a "trade show," of the second series of films made under the auspices of the Federation, a series in which electricity has a very large share.

Such films must be short, must not stress a particular firm's name, and must occasionally turn aside from the strictly technical aspect of the subject treated. We think that the films referred to conform to these requirements, and we hope that the renters will share our view. Although some of the films are not likely to produce direct results for the industries "screened" (for instance, a larger consumption of submarine telegraph cable, or an increase in traffic, is hardly likely to result from the exhibition of the Telegraph Construction and Maintenance Co.'s film), there is no doubt that films showing the many uses of electricity are of real advantage to the electrical industry. They deal with everyday matters and with appliances which are within the reach of a great number of people who will see the films. On this account we hope that their use will continue to expand, although we would appeal to the producers to conceal the "pill" well within the "jam," for people do not like paying to see advertisements.

While upon the subject we should like to refer to another class of film which has an important though perhaps more limited field. This is the purely industrial class, to which we think the before-mentioned cable film really belongs. Large buyers of goods like to inspect processes of manufacture if possible; the exhibition of a film showing these processes is a good substitute in cases where a long and expensive journey is involved. We can recall at least one important result from the showing of an industrial film. This was exhibited by the Swedish General Electric Company in New Zealand to a gathering of members and officials of the Dominion Government. It showed the construction of turbines, generators, electric locomotives, &c., at the company's Vasteras works in a very detailed manner. Almost immediately afterwards the Government placed an order of the value of £500,000 with the Swedish company in connection with the Arapuni hydro-electric scheme, and it was reported on good authority that the decision was influenced by the film.

British industrial films might well produce as good results in oversea markets.

Electrical Manufacturing.

We would direct our readers' attention to a number of electrical manufacturing matters of interest that are reported in this issue. The problems of electrical manufacturers and cable-making companies are set forth in the summary of the evidence given before the Committee on Industry and Trade by Mr. D. N. Dunlop and Mr. L. B. Atkinson. The speeches delivered at the annual meetings of Callender's, W. T. Henley's, the B.T.H., and Siemens Bros. & Co. tell the story of recent experiences of these four well-known electro-industrial companies, and give indications of present problems and the outlook for the future. Those who wish to be informed regarding the present state of the industry should closely study these statements by leaders who are in the thick of the fray.

The I.E.E. Elections

The nomination of Mr. R. A. Chattock for the office of President of the Institution of Electrical Engineers will be welcomed as an honour which has been well earned by the city electrical engineer of Birmingham, who has served the industry faithfully in many capacities, and whose conduct of the great undertaking which he controls has gained for him the confidence of the city Corporation and the esteem of his fellow-citizens. The fact that Mr. Chattock will be the first head of a municipal electricity supply undertaking to occupy the presidential chair confers an added distinction upon the choice that the Council has made, and our readers will join with us in offering hearty congratulations to the President-elect and best wishes for a happy and fruitful year of office.

Amongst the nominations for membership of the Council we note the names of six members who have not hitherto served in that capacity. Prof. C. L. Fortescue, O.B.E., is a leading exponent of wireless communication, and occupies the principal metropolitan chair of electrical engineering. Mr. H. Marryat has done yeoman service in raising the status of the electrical contractor, and Mr. R. W. Paul's work in the invention and development of scientific instruments is common knowledge. Other nominees without previous service are Mr. R. Grierson, Mr. J. W. T. Walsh, and Mr. E. Leete.

E

Invisible Radiation from Illuminants.

A Review of the Facts with regard to Ultra-violet and Infra-red Rays.

By J. W. RYDE (*Research Laboratories of the General Electric Co., Ltd., Wembley*).

It is sometimes claimed in the daily Press that harmful radiations are emitted from certain types of artificial illuminant, so that a clear statement of fact may not be inopportune in order that such rumours as are unsubstantiated by scientific data may not be treated with more respect than is due to them. At the same time, it has been thought worth while to include other data of perhaps more general interest on ultra-violet and infra-red radiation.

Visible light of various colours, ultra-violet and heat or infra-red rays, are all electromagnetic waves, the frequency or wavelength of one of which is a complete specification of the particular type of radiation. The unit of wavelength generally adopted for the shorter waves is the Angstrom unit, which is one hundred millionth of a centimetre and is denoted by the symbol A.U. Thus the wavelength of red light is about 6,000 A.U. and that of violet light about 4,000 A.U. Wavelengths above 7,500 A.U. or below 3,970 A.U. do not appear as visible light. The exact limits, however, depend upon the individual observer.

Ultra-violet radiation is the arbitrary definition applied to wavelengths between the shortest visible and the very short waves of a few A.U. or less, which are known as X-rays. The range of ultra-violet light generally met with comprises wavelengths between 3,970 and 1,800 deg. A.U. Below this the waves begin to be strongly absorbed by the atmosphere, and have to be studied with a vacuum grating spectrograph. Proceeding from the other end of the visible spectrum, the region of wavelengths greater than 7,500 deg. A.U. and below about one-third of a millimetre, is called the infra-red region. Above this we enter the region of short wireless or Hertzian waves. The Angstrom unit is too small for the infra-red range, so that another unit, the micron (μ), which is one-thousandth of a millimetre, is generally used. Thus, the infra-red region comprises wavelengths between 0.75 μ and about 3,000 μ. The gap between the longest infra-red rays and the shortest Hertzian waves generated by a spark oscillator has now been bridged. E. F. Nichols* found the shortest electric waves he could produce and measure had a wavelength of 0.22 mm., while the longest heat waves so far measured have a wavelength of 0.32 mm.

The Energy Distribution.

The radiation from incandescent solids, when analysed by a spectroscope, is almost always found to be continuous, that is, the distribution of energy varies continously from one wavelength to another. When, on the other hand, the radiation from gases or vapours is examined, the spectrum is generally found to be composed of lines, showing that only certain wavelengths are emitted. Sometimes regular groups of lines very close together are found, which are called bands. The line spectra are due to the radiation from atoms, while the bands are due to that emitted from molecules. In the case of the continuous radiation from a hot body, the distribution of radiation intensity among various wavelengths is dependent on its temperature. If it is what is known as a "black" body, that is, one which absorbs completely all radiation which falls on it, the wavelength corresponding to the maximum intensity varies inversely as the absolute temperature. Thus, at 373 deg. K. (100 deg. C.), the maximum radiation intensity lies at 7.8 μ: at 2,500 deg. K. it is at 1.16 μ (11,600 A.U.), while in the case of the sun, whose effective temperature is between 5,000 deg. K. and 6,000 deg. K. depending upon the amount of atmospheric absorption, the maximum lies at about 5,300 A.U. in the yellow-green part of the visible spectrum.

The following table gives the approximate percentage of infra-red, visible, total ultra-violet, and ultra-violet below 3,050 A.U. which is present in the radiation from various sources. Actually the figures in columns 2 and 3 refer to black bodies, but the values for metals and other opaque bodies will generally not be very different.

TABLE I.

—	Black body at 2,350° K (1).	Black body at 3,000° K.	Sun through atmosphere (2).	Quartz mercury vapour (3).	Iron spark condenser discharge (3).
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Infra-Red	96.9	92.2	57-46	13.4	3.5
Visible	3.1	7.6	42-51.8	5.8	6.0
Total Ultra-Violet	0.03	0.2	1-2.1	2.8	9.4
Ultra-Violet Below 3,050 A.U.	0.0009	0.01	(0.2)	6.4	85.9

(1) Approximate temperature of filament in gas-filled lamp.
(2) Coblentz. Bull. Bur. Stds. 16, 1920, 233.
(3) Rough estimates from data given by A. Pfluger. *Ann. d. Phys.* 13, 1904, 890.

It will be seen that only a small percentage of ultra-violet light is emitted from incandescent solids, the majority of the radiation being in the infra-red. On the other hand, in the case of many electrically-excited vapours, which emit line spectra, the reverse is true. With flames such as the candle, bat's wing, or acetylene, the spectrum is mainly continuous and very similar to that given by incandescent solids, but band spectra are also emitted. The ultra-violet energy corresponding to these bands is, however, small.

Physiological Effects.

Physiologists have shown that wavelengths below 3,050 A.U., if present in sufficient quantity, can have a harmful effect on animal tissues. Verhoeff and Bell* in their extensive investigations, found that it is the radiation shorter than 3,050 A.U. which is able to injure animal cells. In the case of injurious effects on the eye they found that an exposure of at least 0.2 watt-second of radiation per sq. cm. of eye surface below this limit is necessary to produce a well-marked photophthalmia, the time of exposure required to produce the symptoms being inversely proportional to the intensity of the effective rays. This, however, does not apply to weak radiation, as in this case no effect at all is produced, owing to "physiological repair." Henri and Moycho† found that 0.057 watt-second of effective radiation per sq. cm. is required to produce irritation of the skin. The most active radiation was found to be at 2,800 A.U.

Amount of Ultra-Violet Radiation from Various Illuminants.

Bearing these quantities and wavelength limits in mind, we will now investigate the amount of ultra-violet present in the radiation from various light sources. Spectrograms of a number of illuminants were taken with a quartz prism spectrograph, the exposure being adjusted by trial so that the density of the part of the resulting spectrum corresponding to the visible region was the same in all cases. The wavelengths of the lowest ultra-violent radiation found are given in Table II. These values are, of course, only approximate as there is no sharp limit below which it can be said that there is no radiation, so that the lowest wavelength observed will depend somewhat upon the time of

* Proc. Nat. Acad. Sci. 9, p. 211, 1923.

* Verhoeff and Bell, Proc. Amer. Acad. Arts and Sci. 51, 1916, 640.

† Henri and Moycho, C.R. 158, 1914, 1509.

exposure. For this reason lower limits for very long exposures are given in some cases, but the intensity of the radiation between these two limits will be very small.

TABLE II.

Source.	Wavelength.	Remarks.
Gas mantle bare ...	3,390	—
Candle bare	3,350	Faint band at 3,061.
110-V, 60-W, Vacuum lamp.	3,220	Long exposure limit 3,080.
Acetylene flame bare ...	3,220	Long exposure limit 2,500; band at 3,061 moderate.
110-V, 60-W, Gasfilled lamp.	3,140	Long exposure limit 3,000.
Sun at noon direct ...	3,080	Long exposure limit 2,930.
" " through glass.	3,300	—
Various arcs and sparks	less than 2,200	Long exposure limit often less than 2,000.
" " " through glass.	3,300	—

The glass used in the cases mentioned in the above table was a sheet of lime-soda window glass about 3 mm. thick. It will be seen that, with the exception of bare arcs, sparks and the sun, the limits in the second column are well above the value of 3,050 A.U., below which the radiations are dangerous. In some cases, however, these short wavelengths are present, although only to a very small extent, as is shown by the long exposure limits.

We will now investigate the amount of radiation less than 3,050 A.U. which occurs in certain cases, and compare it with the amounts given above as being necessary to produce physiological effects. Considering first the radiation from incandescent solids, it will only be necessary to deal with the radiation from black bodies since, for a given temperature and area of radiating surface, the black body emits the maximum amount of every wavelength. Taking the above figures given by Verhoeff, Bell, Henri, and Moycho, together with the percentage of ultra-violet below 3,050 A.U. given in Table I, it is easy to show that the total radiation from an incandescent solid at as high a temperature as 2,500 deg. K., would have to be 55 kilowatts in order that the amount of effective ultra-violet radiation emitted in one hour should be sufficient to produce irritation of the skin if held at a distance of 50 centimetres. To produce photophthalmia under the same conditions, 195 kilowatts of total radiation would be necessary. These figures are so absurdly large that it may be definitely stated that no harmful effects can be produced by the ultra-violet radiation from any incandescent solid under any conditions likely to be met with in practice. A comparison of the intensity distribution in the spectra of other illuminants with that of the black body source at 2,500 deg. K., shows that the above statement also applies to all the light sources listed in Table II, with the exception of the sun, arcs, sparks, and cases such as the mercury-vapour lamp which depend on electrically-excited gases or vapours.

In the case of incandescent filament lamps, the lead glass bulb absorbs much of the radiation below 3,050 A.U.; in fact, it absorbs practically all radiation below 3,000 A.U. Taking the temperature of the filament in the gasfilled lamp as about 2,500 deg. K., it follows that the amount of ultra-violet light of wavelength below 3,050 A.U. radiated from it will be of the order of several thousands of times too small to give a pathological effect in one hour at a distance of 50 cm. Again, from Table I it will be seen that the gasfilled lamp filament, the temperature of which is about 2,500 deg. K., not only emits proportionately less ultra-violet light than is present in natural sunlight, but also, owing to the absorption by the lead glass bulb, the lamp does not radiate the very active shorter wavelengths down to 2,930 A.U., which represents the limit of the solar spectrum after absorption through the atmosphere.

Further, fewer of the longer-wave ultra-violet rays which cause fluorescence of the lens of the eye are emitted from these lamps than are found in sunlight, which in itself shows that no harmful effects can be produced from this cause. In view of these facts, those who criticise the gasfilled lamp from the point of view of its emission of dangerous ultra-violet light, lay themselves open to the reply that if this is the case they had better never venture into the open on a sunny day without elaborate eye protection.

There seems no doubt that the annoyance experienced with naked clear gasfilled lamps is really owing to the "glare," due in this case to the high intrinsic brilliancy of the filament surface. It is not possible within the limits of this article to attempt to deal adequately with the subject of glare, which is dependent on two, if not three, quite separate and unrelated effects. The following table gives the cut-off wavelength and the approximate wavelength below which the absorption is greater than 50 per cent. for glasses 1 mm. thick.

TABLE III.

Glasses 1·0 mm. thick.	Approximate "cut off" wavelength.	Approximate wave length at which absorption is 50%.
Lamp bulb lead glass ...	3,015	3,180
Lamp, lime-soda glass ...	3,160	3,250
Hard borosilicate glass (70% Silica).	2,970	3,170
Daylight glass	3,300	3,550

Protection From Ultra-Violet Radiation.

As mentioned above, the laws of thermal radiation do not apply to sources emitting line spectra, and in these cases it is often found that a relatively large amount of ultra-violet radiation is emitted. For example, from Table I it will be seen that for equal total radiation the amount of dangerous ultra-violet light emitted from a quartz-mercury lamp is over 7,000 times that radiated from a black body at 2,500 deg. K. An exposure of only a fraction of a minute to very powerful arcs may suffice to produce pathological effects, and some sort of protection from their short-wave radiation is essential. It is not sufficient to be shielded from the direct radiation, as with intense sources effects have been known to occur even after the rays have been reflected from fabrics. A sheet of ordinary glass two or three millimetres thick cuts off all the radiation below about 3,100 A.U. and practically all that below 3,500 A.U., thus affording protection unless the short-wave radiation is particularly intense, in which case amber glasses may be used, which generally cut off all radiation below 3,600 A.U. In general, blue glasses are not so good and should be avoided, particularly as Luckiesh* found that the addition of a little cobalt to a certain glass resulted in shifting the absorption limit towards the shorter wavelengths.

In operations such as arc welding it is necessary to reduce the intensity of the visible radiations as well. For this purpose the glass is coloured. Owing to the chromatic aberration of the eye for light at the ends of the visible spectrum, better definition is said to be obtained with amber or yellow-green glasses than with plain red or violet.

Infra-red Radiation.

We will now consider the infra-red or heat rays which, as we have seen, constitute the major portion of the radiation from incandescent solids. It is known that glass blowers who are continually working with hot glass near their eyes sometimes develop "glass blower's cataract." On the whole, however, there seems to be no evidence that the infra-red rays are dangerous, unless the exposures are very long and the radiation intense. This rules out the possibility of any injurious effects from any ordinary artificial illuminant due to this cause. There are cases, however, in which it is necessary or desirable for various reasons to eliminate them, such as, for example, in arc welding, glass blowing, and in optical projection apparatus. It may,

* M. Luckeish J. Frank. Inst. 186, 1918, p. 111.

therefore, not be out of place to conclude with a few notes on infra-red filters.

The following table gives the percentage transmission at different wavelengths and the percentage transmission of the total radiation from a black body at different temperatures for a number of materials. These were obtained with a Hilger infra-red spectrometer.

TABLE IV.

Percentage Transmission of various substances for infra-red Radiations of different wavelengths.

Wavelength in μ.	Lamp Bulb, Lead Glass, 1·0 mm.	Ordinary Soda Glass, 1·0 mm.	Daylight Lamp, Bulb Glass, 1·0 mm.	Quartz, 1·0 mm.	White Mica, 0·13 mm.	Dark Brown Mica (Biotite), 0·13 mm.	White Fluorite, 1·0 mm.	Water in Glass Cell, 1·0 cm.
1·0	87	88	26	92	92	6	92	67
1·5	90	90	50	92	92	13	92	
2·0	91	90	70	92	89	64	94	
2·5	86	89	83	92	67	75	93	
3·0	77	70	75	91	58	82	92	
3·5	64	62	65	90	83	88	94	
4·0	62	60	60	75	91	84	95	
4·5	26	20	25	42	76	80	95	
5·0	5	4	5	6	60	60	95	
5·5	2	2	2	—	24	33	95	
6·0	—	—	—	—	27	19	95	—

It will be seen that ordinary glasses 1.0 mm. thick do not offer much protection. Some coloured glasses, particularly the blue-green varieties, cut off the infra-red very effectively, while transmitting most of the visible radiations. A pale blue-green glass, the colour of which is produced by the presence of iron in the ferrous state, was found by Crookes to be particularly good in this respect. Coblentz* has shown that the best liquid filter to absorb the infra-red, while transmitting most of the visible spectrum, is a 2 per cent. solution of copper chloride. A 5 per cent. solution cuts off practically everything above 6,500 A.U. A solution of alum is very little better than plain water. On the other hand, as shown by the above tables, a sheet of dark brown mica (biotite) 0.13 mm. thick lets through about 50 per cent. of the infra-red, while absorbing almost all of the visible light.

TABLE V.

Percentage Total Transmission of Black Body Radiation.

Temperature of black body.	Lamp Bulb Glass (Lead), 1.0 mm.	Daylight lamp, Bulb Glass, 1.0 mm.	Quartz, 1.0 mm.	White mica, 0.13 mm.	Dark brown mica (Biotite), 0.13 mm.	Water in glass cell, 1 cm.	[illegible] (Cl Cl) in glass cell, 1 cm.
2,340° K.	77	49.5	81.5	79	39	17.7	6.0
1,825° K.	72	53.5	75	73.5	49	8.2	2.6
1,310° K.	54.5	48	63	65.5	57	1.7	0.5
1,000° K.	40	38.5	47	57	54.5	0.1	0.05

* Coblentz. Bull Bur. Stds. 7, p. 659.

The "Repairs" Organisation—III.

The Functions of the Travelling Organiser.

The necessity for a repairs organisation being recognised, steps must be taken to ensure its efficiency, and in this connection it is apparent that, as the organisation must operate throughout the country, the various districts must be linked up with headquarters. In the factory itself there is a definite repairs section, presided over by a man who virtually controls the whole organisation, but as this individual must perforce spend the greater part of his time at headquarters, his knowledge of the happenings in the various districts is obviously governed by the information he receives.

The head of the repairs section is responsible for the technical side of the selling organisation, this whether he enjoys independent control, or is subservient to the authority of the sales manager. It is his duty to investigate all complaints relating to mechanical defects, and to advise the sales manager on all matters appertaining thereto. He is responsible for all estimates for repairs, and his decision with regard to refusing or accepting work must in all cases be accepted.

He is the customer's man rather than a factory man, in the sense that he looks at matters from the customer's standpoint. This does not mean that the factory is penalised upon each and every occasion, but he is able to visualise the root of the trouble, and is not prepared to shield the factory at the expense of the customer. In other words, he judges the product from a utility standpoint, with a full understanding of what the unit should be capable of doing. He knows under what conditions the specific unit is at work, and his opinions are based upon them.

It will be seen from this that he must *know* the customer, and he must possess the attributes of the "super-salesman." He it is to whom the salesman turns when the consequences of some mechanical defect threaten to exhaust the latter's resources, and he it is who, by his tact and intimate knowledge of the customer, the product, and the circumstance, pours oil upon the troubled waters and assuages the storm.

He is not concerned with the selling of new products, except that his experience is at the service of the salesman in times of emergency. He is an expert demonstrator, and an adept at convincing an obdurate client, for he makes the machine do what he wills. The sceptical client finds it difficult to resist his pertinacity, and yet he is not conscious of being persuaded to buy. All that the "super-salesman" does is to demonstrate that the machine will satisfy the customer's requirements, by getting at the soul of the machine and bringing to the surface hitherto hidden capabilities. He rarely fails to achieve his purpose, for even though immediate results are not always apparent, the impression he has left behind is the powerful ally of the salesman, whose subsequent visit usually proves productive.

As mentioned earlier, however, the chief's place is at headquarters, and he cannot afford to spend a deal of time in roaming the country. As likewise he cannot afford to allow his organisation to become just a number of disjointed units, he connects up the links of the chain by means of a travelling organiser. This individual, whilst not necessarily an expert mechanic, nor yet an expert salesman, is nevertheless a keen business man, whose duty it is to exploit to the utmost every available facility.

There are many troubles in the district which are so small that they do not appear worthy of official notice, and yet these, if allowed to develop, are likely to have far-reaching consequences. The salesman, whilst appreciating that the trouble exists, is not always conscious of the precise location, and despite the fact that he is labouring under a disadvantage, he does not feel that he can report to his chief something which is undefinable, or what he terms a "misgiving."

The travelling organiser is a man of keen perception, and he can visualise a "misgiving" in no uncertain manner, making it a concrete fact, for which a remedy is forthcoming. He sees the thing with startling clearness, not as something undefined and shadowy, and he knows the course to adopt. Just as the salesman is an expert in the art of selling, so is the

organiser an expert in all matters appertaining to organisation, for he is the doctor, whose mission it is to keep every unit of the organisation fit, from the standpoint of efficiency.

Before following him upon his travels, let us briefly view the organisation in order to see what he is called upon to perform. Associated with the factory are the sales office and the repairs section, and, in various parts of the country, there are the district depôts. Assuming headquarters to be in London, the country is divided into various districts as follows:—(1) Scotland, (2) Northern, (3) Midlands, (4) Eastern, (5) Wales, and (6) South-Western, and in one town in each of these districts a sales office is located, with a repairs depôt attached. It will be noted that these districts cover a wide area, so that the nature of the product and the volume of business necessitates a system of sub-division, which may be one of the following:—

(1) A number of sub-offices are opened, some with and others without a repairs section, and the salesmen attached to these offices take their instructions from the district sales manager. Taking the Midlands district as an example, the district office is at Birmingham, but there are sub-offices at Nottingham, Coventry and Oxford. Each sub-office administers to a prescribed area, each salesman reporting to the sub-office responsible for the area in which he travels, and his reports being transmitted to the district office in Birmingham.

(2) There is but one office in each district, but there is a resident salesman in each of a dozen towns. Each salesman sends his reports to the district office, and acts upon instructions emanating from the same source. It is obvious that in this case there is but one repair shop, situate, say, in Birmingham; and as the handling of repairs in these circumstances could not be expeditiously performed, we may assume that, in the organisation under review, the sub-dividing is on the lines of example number 1.

The travelling organiser, as has been pointed out, is not directly concerned with the selling of the product, nor yet with the execution of repairs. His business is to organise, and, assuming that the Midlands district is his first objective, he travels to Birmingham. It does not follow that, because he journeys thither, business is bad. It may be in a very promising state, but then at certain times that can easily happen, even though everything is not as it should be. The policy of leaving well alone does not always ensure "well" continuing, and however "well" things may be, there is always the possibility of their being better.

Business may be good, but expenses may be disproportionately heavy. It is true that anybody can get business, if sufficient inducements are offered, but the business gained as a result of these inducements may not be of the paying variety. The man who offers an article obviously worth £20 for, say, £10 is quite likely to effect a sale, but it is a sale that his firm would not welcome. It is the same with the district office. It may be doing good business, but with the facilities at its disposal it should be doing better, or, the same volume of business could be maintained with less expense. It is the business of the organiser to determine this.

The organiser represents the sales manager as well as the head of the repairs section, but, as he should be directly responsible to one man only, it is better for him to report to the latter, who, with his profound knowledge of every phase of the organisation, is able to appreciate the significance of every detail.

The organiser may find that the district office is over-staffed or under-staffed; that certain matters are being duplicated, and that others are being neglected. He may find that the suggestions made upon the occasion of his previous visit are not being carried out, or that they are being misinterpreted; or he may consider that sufficient enterprise is not being shown.

He visits the sub-offices, and again he may find that a complete understanding does not exist between the sub-office and the head office of the district. Instructions from the latter are not adhered to, or the officials in the sub-office complain of the treatment they receive. These are the points that do not get into the letters and reports forwarded to the head sales office, and these are the points which, if allowed to develop, will sooner or later cause an eruption and have an adverse effect upon business.

The organiser is quite unbiased, and his judgment is uninfluenced by personal feeling. Concentrating upon the one phase, he is able to analyse it, and any statement that he receives is judged dispassionately. If he is master of his job, his words inspire confidence, and he can make others see through his own eyes. The man handling a mass of detail is apt to miss something, but this can always be found by the man looking for it.

The salesman pours forth his troubles, and the organiser perceives the cause. The salesman tells of his successes, and the organiser detects a weakness which has robbed the triumph of some of its value. Here he sees a salesman who has been pursued by sheer bad luck, and there he sees one who has succeeded, despite obvious shortcomings.

He may find the mechanic at variance with the salesman, for the latter's authority is but nominal. His instructions are carried out, but in the letter only. The organiser, representing the chief of the mechanics, can effect improvements, for what he says is law.

The mechanic may alienate the customer. He may be too talkative—too familiar; or he may be too taciturn or unresponsive. He may, by his manner, undo all the good work of the salesman, by expressing a contrary opinion on the merits of the product, and so his personality must be studied. The organiser can be of the utmost assistance to his chief in this respect, for the mechanic with the best of reputations inside the factory may become a different being in other circumstances.

The organiser seeks to frame a common policy, yet one which can be adapted to the peculiarities of the district. If each district has its own methods, the work of the head office is materially increased, whilst real satisfaction is never attained; but if, on the other hand, a common policy prevails, superfluous and unnecessary work is eliminated, and efficiency increases.

The organiser perhaps cannot give definite instructions in every instance, but his report covers every suggestion and instruction that he has given. The larger matters, upon which no decision is given, must be referred to his chief, but the report should include recommendations. All reports must be clear and concise, and of a helpful character. They must be compiled so that, when read, the precise position is at once apparent to the chief. Such a linking-up as the one described is necessary in the interests of efficiency, for it makes it possible for the detailed working of every district to be known at headquarters, just as though the chief himself were on the spot and conducting operations.

Loud-Speaker Train Indicators.—The London, Midland and Scottish Railway recently carried out further loud-speaker tests for train announcing at St. Pancras Station, and they were a complete success. An 18-valve set installed in a luggage wagon at one of the platforms was connected with four Marconiphone trumpets at the best sound-points. Times of departure and alterations of platforms were announced, and it was found that the crowds were easily and quickly controlled, says *The Times*.

A comparative test as between a man's voice and a woman's was made and it was found that the man's voice was clearer and had greater carrying power. The outfit is intended for use in fog and heavy holiday traffic, when trains are not running to normal schedules, and it is believed that they will be of great assistance both to porters and passengers.

International Railway Congress.—Among the questions to be discussed at the London Session of the International Railway Congress Association, which will be held from June 22nd to July 2nd, are the following:—High speed electric locomotives, dispatching or control systems, Mr. J. H. Follows (L.M. & S. Railway), English reporter. The general organisation of suburban services, including tubes, on lines exclusively used as such, the lay-out of stations and lines, signalling, rolling stock, &c., Messrs. E. C. Cox (Southern Railway) and A. R. Cooper (Met. District Railway), English reporters. Fixed signals, the principles of signalling for lines with dense traffic and for large stations, forms of day and night signals, signal lights, automatic block signals, Mr. W. J. Thorrowgood (Southern Railway), English reporter.

Power Transmission Lines.

Calculations for the Size of Wooden Poles.

By W. T. TAYLOR, M.Inst.C.E., M.I.E.E., Fel.Am.I.E.E.

THE method given herein is expressly intended to supersede that given in connection with Chart IX in the November 7th, 1924, issue of this journal.

Neglecting angle and dead-end line supports, in making calculations for the size of wood poles, it is sufficient to take into account the maximum wind pressure (transverse force) which may be exerted on the line wires and conductors and the wind pressure (transverse force) on the poles themselves, and the sum of these two transverse pressures is the determining factor. The vertical weight of the line conductors and wires—

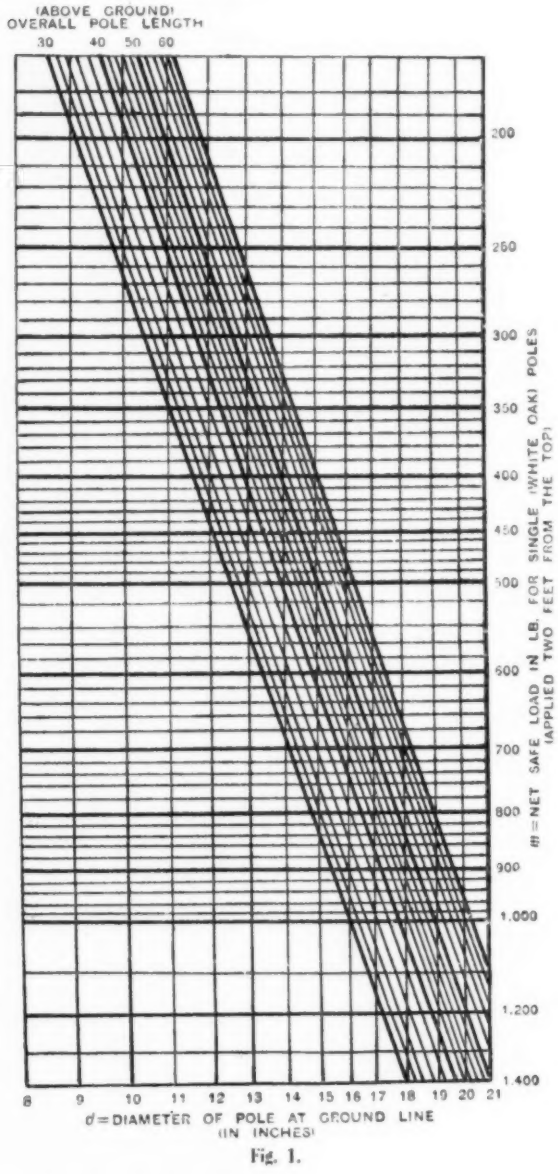


Fig. 1.

acting downwards—puts a crushing strain on the poles, and it is not taken into account.

In this country white oak and red fir poles are extensively used, and fig. 1 is based on the highest grade of white oak; the values of *m* make allowance for a factor of safety of 3.5 and wind pressure on the pole. For a pole without side stays, multiply values *d*, obtained from fig. 1, by 1.25. The *m* values are based on Regulations 7 and 14 of *Regulations E*1, *C*39, which specify that:

(*a*) The factor of safety of wood shall be 3.5;

(*b*) the factor of safety of line conductors shall be 2.0, based on the breaking load and calculated on the assumption that the line conductors are at a temperature of 22 deg. F., and have a covering of ice to a radial thickness of half an inch, and that they are simultaneously subjected to a wind of 50 miles per hour at right angles to the line, this wind to be taken as exerting a pressure equivalent to 8.0 lb. per sq. ft. calculated on the whole of the projected area of the ice-covered lines.

Tables I and II are for standard sizes of copper conductors, and are based on the latter (*b*) regulation. Table III is for standard sizes of galvanised steel wire.

Because of the decay at the ground line of a wood pole, the maximum stress should be taken at that point—in other words, a wood pole is weakest at the ground line, but the ground line is not necessarily 5 ft. from the butt, which is more commonly that part of the pole referred to.

TABLE I.

COPPER WIRE, STRANDED, BARE (hard-drawn).

No. and dia. (inch) of wires.	Nominal area (sq. inch).	Approx. overall diameter (inch).	Dead load per lineal foot. (a)	(Vertical) load per lineal foot. (b)	(Horizontal) load per lineal foot. (c)	Max. load per lineal foot. Plane of resultant. (d)	Angle of resultant load. (e)
3/·104	0·025	0·224	0·1002	·549	·816	·984	56° 01
3/·147	0·05	0·317	0·2002	·707	·878	1·127	51° 10
3/·180	0·075	0·388	0·3001	·851	·926	1·257	47° 25
7/·136	0·100	0·408	0·3986	·962	·939	1·342	44° 20
7/·152	0·125	0·456	0·4866	1·079	·971	1·451	42° 0
7/·166	0·15	0·498	0·5940	1·213	·999	1·571	39° 25
7/·180	0·175	0·540	0·6983	1·343	1·027	1 690	37° 25
7/·193	0·200	0·579	0·8026	1·472	1·053	1·810	35° 35
7/·204	0·225	0·612	0·8970	1·587	1·074	1·915	34° 10
7/·215	0·25	0·645	0·9963	1·706	1 089	2·019	32° 40
19/·144	0·3	0·720	1·2153	1·972	1·146	2·280	30° 5
19/·166	0·4	0·830	1·6150	2·440	1·220	2·73	26° 35
19/·185	0·5	0·925	2·006	2·990	1·284	3·25	23° 15

TABLE II.

COPPER WIRE, SOLID, BARE (hard drawn).

Nominal area (sq. inch.)	Diameter (inch).	Dead load per lineal foot. (a)	(Vertical) load per lineal foot. (b)	(Horizontal) load per lineal foot. (c)	Max. load per lineal foot. Plane of resultant. (d)	Angle of resultant (loaded). (e)
0·01453	0·136	0·0560	0·451	0·758	0·882	59° 15'
0·01629	0·144	0·0627	0·462	0·763	0·892	58° 50'
0·01697	0·147	0·0642	0·466	0·765	0·896	58° 30'
0·01815	0·152	0·0700	0·474	0·768	0·902	58° 15'
0·02061	0·162	0·0795	0·490	0·775	0·917	57° 35'
0·02164	0·166	0·0834	0·497	0·778	0·923	57° 20'
0·025	0·178	0·0959	0·516	0·786	0·940	56° 45'
0·02545	0·180	0·0981	0·520	0·787	0·943	56° 35'
0·02688	0·185	0·104	0·528	0·790	0·951	56° 10'
0·02926	0·193	0·113	0·542	0·795	0·962	55° 40'
0·03269	0·204	0·126	0·563	0·803	0·981	54° 55'
0·03631	0·215	0·140	0·583	0·810	0·998	54° 15'
0·05	0·252	0·193	0·659	0·835	1·064	51° 40'
0·075	0·309	0·289	0·791	0·873	1·178	47° 5'
0·100	0·357	0·386	0·917	0·905	1·288	44° 40'
0·125	0·399	0·482	1·040	0·933	1·379	41° 50'
0·15	0·437	0·578	1·159	0·958	1·504	39° 25'
0·175	0·472	0·675	1·277	0·982	1·610	37° 35'

NOTE: d = resultant of vertical loading (a) and (b), and a horizontal transverse load (c) due to 8·0 lb. per sq. ft. wind pressure; (a) = dead weight of conductor; (b) = ½-inch radial coating of ice.

In calculating pole sizes, it has more often been the rule to assume a certain diameter or circumference of a given kind of wood (oak, fir, &c.) having a certain fibre stress, and calculate the total allowable force when acting at given heights above the ground line. As cer-

tain condition are known, such as the height of the pole above the ground line, the height of line conductors and wires and the depth of pole in the ground, it would seem more desirable to take these known conditions and then determine the size of pole.

It is usually understood that the single "A" frame is about 4.5 times as strong transversely as the single pole; also, the wind pressure on a single "A" frame is usually taken at between 1.5 to 1.75 times that on a single pole. And the average transverse forces of the line conductors and wires are usually taken as acting 2 ft. from the top of the pole, which for most lines is, at the present time, found to be a reliable mean. However, the diameter of the pole is usually taken at a point 5 ft. from the butt, and no consideration is given to the height of the line support, ground material, &c.

TABLE III. STEEL WIRE — STRANDED — GALVANISED.

Size.	Diameter inches.	Area sq. in.	Siemens-Martin		High tension		Load per lineal foot vertical		Load per lin. ft. horizontal 4 lb. p. sq. ft. Cond. ½ ice.	Maximum load per lineal foot result.	Angle of result. Load.	(E A) $e = 29,000,000$
			Ult. tens.	Allow. tns.	Ult. tens.	Allow. tens.	Dead.	Dead ½ ice.				
5/8	6250	·2355	19,000	9,500	25,000	12,500	·821	1·520	1·083	1·867	35° 30′	6,832,000
9/16	·5625	·1922	14,500	7,250	21,100	10,550	·668	1·329	1·042	1·689	38° 0′	5,574,000
1/2	·5000	·1443	11,000	5,500	18,000	9,000	·510	1·182	·999	1·510	41° 30′	4,185,000
7/16	·4375	·1204	9 000	4,500	15,000	7,500	·415	·998	·958	1·383	43° 25′	3,492,000
3/8	·3750	·0842	6,800	3 400	10,500	5,250	·295	·839	·917	1·243	47° 50′	2,413 000
5/16	·3125	·0606	4,860	2,430	8,100	4,050	·210	·715	·875	1·130	50° 45′	1,757,000

In the use of the chart, fig. 1, it is necessary to determine—

$$W = kL(x'h_w) + (x''h_w) \ldots \quad \ldots + (x^n h^n) \ldots \text{lbs.}$$

where L = span length in feet;

h = transverse force in lb. per ft. of span on the wires and conductors;

x' x'' x = number of attachments of equal weight at the same height.

k = allowance for different grades of wood, *i.e.*,

= 1.1 for ordinary-grade white oak;

= 1.2 for ordinary-grade red fir.

Note.—Wind pressure on the pole is allowed for in the chart.

To illustrate the use of the chart, assume that it is required to erect a three-phase wood-pole line using side-stays with an overhead earth wire, as follows:—

One 7/16-in. steel stranded galvanised cable, fixed 2 ft. above the top of the pole.

Three 7/.215 (.25 sq. in.) hard-drawn stranded copper conductors; one conductor 1 ft. below the top of the pole and the other two conductors on another crossarm 2.5 ft. below the top of the pole.

Red fir poles are used with average spans of 200 ft.

Total or overall length of pole determined upon after allowance is made for minimum height prescribed by law, maximum sag at summer temperature of 122 deg. F., &c., is 36.0 ft.

Height or overall length of pole above the ground line is 30 ft.

Then $1.2 \times 200 \times 1 \times 1.089 = 261$

$1.2 \times 200 \times 2 \times 1.089 = 522$

$200 \times 1 \times 0.958 = 191$

974 lb. net load.

From the chart it is seen that a 16-in. pole diameter at the ground line will fill the requirements. Also, if we omit the overhead earth wire, leaving a net load of 783 lb., a 14.5-in. red fir pole will do.

The value 1.089 is obtained from Table I and value 0.958 from Table III.

Electric Home Visit.—On Wednesday last week a number of members of the Women's Electrical Association paid an official visit to the "Magnet" Electric Home of the General Electric Co., Ltd., in Kingsway, which has already been described in these pages.

Parliamentary.

[By Our Special Parliamentary Reporter.]

The Worksop Case.—On May 27th, Mr. R. MORRISON asked the Minister of Transport if he was aware that in March, 1924, the Electricity Commissioners desired the Worksop Urban District Council to approach the Derbyshire and Nottinghamshire Electric Power Company relative to a bulk supply; that the company's terms were found to be prohibitive, and a few weeks ago negotiations were broken off; that on March 31st last the Commissioners requested the Worksop Council to approach the Rotherham Corporation to ascertain whether a bulk supply could be obtained, and as a result an agreement was arrived at within 10 days respecting terms; if he could state for what reason the Commissioners now refused to sanction the agreement; was he aware that, unless something was done quickly, the ensuing winter would find the Worksop Council unable to give its customers an adequate supply; and would he instruct the Electricity Commissioners either to allow the Council to extend its own generating station or permit the carrying out of the agreement.

COL. ASHLEY said that the negotiations in connection with the provision of additional supplies of electricity required by the Worksop undertaking had been protracted owing to legal and other difficulties. The Electricity Commissioners had now decided to approve the extension of the Worksop generating station.

Broadcasting Revenue.—On May 26th, in reply to Sir W. Lane Mitchell, who asked what was the amount of money collected for broadcast licences and the amount paid to the British Broadcasting Company, Sir W. MITCHELL-THOMSON, the Postmaster-General, said that the amount collected up to March 31st, 1925, was about £1,240,000, and the amount paid to the British Broadcasting Company to date was £622,000.

Private Bill.—On May 28th, the South Wales Electrical Power Distribution Company Bill received the Royal Assent by Commission.

Wolverhampton and Walsall Corporations' Bills.—Agreement having been reached on certain points between the promoting Corporations and the Wolverhampton Tramways Co., the Local Legislation Committee of the House of Commons passed these Bills for report and third reading on May 28th.

Adjournment. — On May 28th the House adjourned for Whitsuntide and will re-assemble on June 9th.

Reviews.

Organisation and Administration of the Electricity Undertaking. By C. L. E. STEWART, M.I.E.E., Borough Electrical Engineer and Tramway Manager, Borough of Rawtenstall. Pp. x + 169. London: Sir Isaac Pitman and Sons, Ltd. Price 6s. net.

This book is one of "Pitman's Municipal Series." As such it is primarily addressed to municipal undertakings, but with small modifications it equally applies to companies. The subject matter of the book is, we think, one of great importance. Good organisation and good management is everything in a supply undertaking—but it is a point not always fully realised. Everybody who has had much to do with supply undertakings intimately, knows how much inefficiency is often traceable to slip-shod and irregular administration and organisation. Too many small undertakings have nothing that one can dignify by the name of "organisation"; they simply muddle along. So any book which directs attention to the pressing need of systematic organisation does indeed fulfil a great service.

Mr. Stewart treats his subject in a discursive rather than a strictly formal way. He seems to range chattily somewhat outside the immediate theme at times, but readers may not find this a drawback. He gives a number of forms relating to the various departments, varying from fuel test returns and boiler logs to monthly analyses of costs, and we think the book should be of considerable use to the moderate-size and smaller undertakings to which it is addressed.

There are, we find, a number of corrections which might be made to the book in any subsequent edition.

Mr. Stewart states that "the Government under the guidance of the Commissioners, put forward a Bill in Parliament in 1919 for the formation of Joint Electricity Authorities." The Commission, however, was constituted by the Bill and the Com-

missioners were appointed thereafter. Mr. Stewart is probably referring to the fact that Sir John Snell and Mr. Booth assisted on the Bill, but this was, of course, prior to their being appointed Commissioners, and the other Commissioners, Sir Harry Haward, Mr. W. W. Lackie, and Mr. A. Page, were not called in. In the short history the author gives of the Act, 1919, there seems to be some confusion. No mention is made of the Joint Boards which were deleted from the original Bill, but instead only the Joint Electricity Authorities are mentioned, though these, of course, did not appear in the original Bill and were only inserted during its passage. The most important omission is that there is no mention of the Act of 1922. The author mentions the "compulsory financial clauses" being struck out of the Act, 1919, but makes no reference to the financial provisions being inserted in the Act, 1922.

In writing of the Whitley National Council, Mr. Stewart states:—"The employer's representatives are elected annually by the thirteen District Councils, each district sending two representatives." The position is, however, that the District Councils elect only *one* representative—a municipal representative. The company representatives on the National Council are appointed direct (without any reference to the District Councils) by the three company associations—the Power Companies Association, the London Companies Conference, and the Provincial Companies Committee.

On page 5, Mr. Stewart "estimates" the number of municipal undertakings and gives the figure as 256. The Commissioners' Annual Report, however, gives the official total, *viz.*, 335.

We think that Mr. Stewart might have very appropriately included a recommendation to all managers, engineers, and chairmen of Electricity Committees to make themselves familiar with the Acts which govern the industry. We have always urged a close study of the Acts. Every manager should know the statutory obligations that have to be observed, and the sub-managers should know, at least, the law as it applies to their departments. Mr. Stewart lays it down that the mains superintendent "must be fully acquainted with all the rules and regulations laid down by the Government Departments, including the Board of Trade, Home Office and Post Office," but there is also a good deal in the Electric Lighting Acts which it is most important for a mains superintendent to know. A useful note in this chapter would have been a reference to the particular sections of the various Acts which especially apply to the distribution and mains department. For instance—to take a simple one—the attention of the mains superintendent and the power station superintendent might very well be called to, say, Section 31 of the Act, 1919, which requires a certain notice to be posted up with a penalty for default. It is on such points that a book like this, appealing as it does to administrative officers, might have been very useful, since there is no royal road by which engineers and managers can become acquainted with all their very miscellaneous obligations, and consequently any guidance should be very welcome.

Speaking of law, we note on page 60 that Mr. Stewart, referring to the metering of supplies to large consumers, says: "it is quite general to put to meters in series and to take the average of the two." Mr. Stewart does not say on what grounds he thinks this is formally legal. Section 49 of the Clauses Act, 1899, refers to "an appropriate meter" as the means of ascertaining the value of the supply, and Section 57 says that subject to dispute and reference to an electric inspector—"the register of the meter shall be conclusive evidence." In the case of power companies there is in some of the Acts a special provision by which three meters may be installed and the average of the readings taken, but whether an adaptation of this, as referred to by Mr. Stewart, falls within the Clauses Act, 1899, is a point which might have been elucidated. Under Section 59 the undertakers can certainly put in a second meter, if they so choose, but this does not necessarily involve the legitimacy of charging an "average" of the two readings.

Chapter VIII deals with the Publicity Department. We certainly think the author might have drawn the attention of his readers to the Electrical Development Association, which is specially useful to small undertakings.

Referring to appliances lent on hire, Mr. Stewart writes:—"An arrangement can be made with the department whereby apparatus may be hired by the consumer on the payment of small sums at regular intervals until the amount paid entitles him to complete possession." But how does Mr. Stewart reconcile this with Section 23 of the Act, 1919, which provides that any local authority may let for hire apparatus "but *shall not*, unless expressly authorised to do so by the Special Act or Order, manufacture, or sell"?

On page 94 is given the procedure advised in dealing with applications for supply. It is suggested that the application form should be passed on to the mains superintendent. Here, however, we come on what is a weak spot in many undertakings. The thing that has to be safeguarded is that consumers shall not be connected up and, by a slip, not notified to the head office and so not be charged for supply. A routine that safeguards this is that the mains superintendent should never connect up unless he receives a service order from the head office. This order is a tear-off, so the counterfoil is always at head office and when the service is completed the mains superintendent returns the order and it is gummed on to its counterfoil, thus completing the record. The applications are carefully kept at head office and the service order book is periodically checked. This leaves no loophole.

As regards consumers being "sound financially," Mr. Stewart refers to inquiries being made, but does not point out that deposits may be asked for under Section 27 of the Clauses Act, 1899.

In dealing with consumers' accounts, it is advised that "the clerk who enters up the readings should carefully note wide fluctuations in the consumers' consumption and look for some explanation." It would have been better, perhaps, to have given more specific directions—say, for instance, that the new reading should be compared with the reading for the corresponding quarter in the previous year and a list be given to the meter reader so that he may take a check reading of the meter and, if this is correct, try and find out from the consumer what diminution of use has taken place.

The model form of application for supply is useful, but reference should be added on the form that the supply is given under and subject to the Acts. This is not only generally protective, but makes it quite clear that the application form in no way modifies the position as between the undertaker and consumer laid down statutorily. We notice that on the specimen form is given an item "Minimum charge £1 per annum." We question whether this is a proper form in which to express the minimum charge. In most, if not all, Provisional Orders the minimum charge is authorised at so much *per quarter* and formally this is the only way in which it should appear on the application form, that is, assuming the form is to be consistent literally with the powers of the undertaking. We know that in practice—with the consent of the consumer, in fact to oblige him, the quarterly charge is sometimes compounded into an annual one—but this does not affect the point as to the appropriate way of dealing with it on a legal document, such as an application form.

We are afraid that the number of points on which we differ from Mr. Stewart may make it appear that we depreciate the general value of the book. This is the reverse of our intention. We are convinced that the big amount of labour which has obviously been expended on the book justifies its serious consideration by all the undertakings addressed—particularly as the subject is one of such importance and so little realised as such generally. The large number of model forms given in the book ought certainly to be of much practical value.

West Riding Electricity Supply.

Yorkshire Power Company Withdraws from Scheme.

AN important step with regard to electricity supply in the West Riding has been taken by the directors of the Yorkshire Electric Power Company, the effect of which is to break away from the scheme submitted to the Electricity Commissioners for the reorganisation of supply in the West Riding (Aire and Calder) Electricity District.

Its decision has been communicated to local authorities in the West Riding in a detailed memorandum, in the course of which it is stated that following the passing of the Electricity Supply Act in 1919, the Electricity Commissioners considered proposals for the reorganisation of electricity supply in the Aire and Calder District, and after an inquiry in May, 1921, a scheme was formulated, which was considered by the company in conjunction with the principal municipalities in the district. At a second inquiry in 1924 agreement was come to between the principal parties, with the approval of the Commissioners, as to the form the scheme should take.

The rejection of the Parliamentary Bill which was necessary for the confirmation of the scheme, and which the company promoted at its own expense, made it impossible to proceed with the scheme in its agreed form, but at the Commissioners' request the company explored the possibility of giving effect to the scheme by the provision of an Order by the Commissioners supplemented by agreements with the principal municipalities supplying electricity in the district. The terms of the proposed agreements were discussed with the Commissioners, but it became apparent that there was considerable doubt as to the legality and effectiveness of the arrangement. Eminent counsel consulted by the company advised that in their opinion the terms of the agreement come to at the second inquiry in 1924 could not be given effect to in the manner proposed.

In consequence "The directors of the company, while regretting the necessity, have reluctantly decided that further attempts to carry out the scheme will be of no avail, and that the company must proceed with the development of electricity supply entrusted to them on the lines laid down by Parliament when the Yorkshire Electric Power Act was granted. It has always been the view of the company that development on these lines would result in the provision of a general supply of electricity in their area in an economical way, and though the company fell in with the Commissioners' wishes and used their best endeavours to carry through the Commissioners' scheme, they are of opinion that development which has taken place in recent years has gone far to solve the problem of a cheap and abundant supply of electricity in their area, and that a new organisation, such as was proposed by the scheme, is not necessary to this end.

"Already in the Aire and Calder District, as in other parts

of the company's area, a very large proportion of the total amount of electricity used for public supply is generated in large and efficient stations, and the provisions which are being made for extensions will assure the complete supersession of the few remaining small generating stations.

"The large majority of distributing undertakings in the company's area are supplied by or are working in conjunction with the company, and the development of electricity supply for domestic uses is proceeding at an unprecedented rate. The greater part of the company's area is covered by a system of distributing mains, and now that the reasons for holding back developments in the north-western part of the area are removed, the company are prepared to deal with the whole of their area without further delay."

It is pointed out in the memorandum that the association of the company with local authorities distributing electricity and with Electrical Distribution of Yorkshire, Ltd., has made it possible to provide over a wide area, not only a supply of electricity for power, but for all other uses, and during the past year the Distribution Company alone has provided a supply of current to several thousand cottages as well as to larger houses. "The local authorities who now buy electricity in bulk in place of generating in small and inefficient stations, have found it possible to make substantial reductions of price, and they also are making large extensions to supply new consumers."

Finally, the directors state that if all the various developments of electricity supply in the company's area are taken into account, with the extensions now proposed, it is the company's view that progress on present lines will secure the best results, and that whatever views were taken by others as to the necessity for reorganisation when the matter was first discussed in 1919, they will, if the present position is considered, be led to the conclusion come to by the company.

Business Notes.

British Plant for South Africa.—In connection with the electrical power transmission schemes that will link up important South African mining areas, orders for sub-stations and equipment have been placed with the Metropolitan-Vickers Electrical Co., Ltd. Power is generated at the Witbank station of the Victoria Falls and Transvaal Power Co., Ltd., and will be transmitted to Brakpan, 65 miles away, at 132,000 V. In addition to serving local consumers, including collieries and the township of Witbank, the system will supply mining undertakings on the Rand, and there is a probability that it will also serve the railways when they are electrified. Each sub-station covers an area of approximately 3,000 square yards and consists of a large steel structure about 50 ft. high and comprising about 300 tons of light latticed steel trestles and girders designed to support the switchgear and to take the strain of the overhead cables which connect to the structure at different angles at a height of 45 ft. above ground level. Messrs. Heenan & Froude, Ltd., are manufacturing and erecting the steelwork, each piece of which will be galvanised before despatch.

Wireless Retailers.—At a recent meeting of the Council of the Wireless Retailers' Association, which we are informed was largely attended, the following resolutions were passed:—(1) That manufacturers be approached individually for the purpose of ascertaining whether they are willing to take action in cases of price-cutting reported by this Association. (2) That in connection with the recent reduction in the price of valves this Association desires to point out to the Valve Manufacturers' Association the gross injustice of allowing rebates only on valves purchased in April and urges that allowances be made in respect of all valves in the hands of members at the date of the reduction.

F.B.I. Films.—On May 27th, a "premier presentation" of a number of films produced under the auspices of the Federation of British Industries, took place at the Cinema House, Oxford Circus, W. Five films were shown:—"The Story of Cotton"; "The Oxford University Press"; "The History of Electricity"; "Cable-Making"; and "The Magic of Nitrate of Soda." The electrical film is one of the E.D.A. series, and shows the generation of electricity at a large modern station in a popular manner. A number of lighter touches ensure the holding of the attention of a "lay" audience. The cable-making film shows the production of a submarine telegraph cable at the works of the Telegraph Construction and Maintenance Co., Ltd., from the stranding of the wires to the shipment of the completed cable. The other films, while not electrical, were excellently produced. Other films which are included in the No. 2 series recently "released" by the F.B.I. are "Modern Lighting," showing the making of electric lamps; "Telegraphic Transmission"; "Overseas Communication"; and "How the Money Goes"—another popular electrical film. Praise is due to the Gaumont Co., Ltd., for the way in which the films have been produced.

Locomotive Battery Order.—The D.P. Battery Co., Ltd., has received an order for "Kathanode" batteries in connection with six electric locomotives which are being constructed for the War Office and the Air Ministry by the English Electric Co., Ltd., Hawthorne, Leslie & Co., Ltd., and Joseph Booth Bros., Ltd.

Trade Announcements.—The DELCO-LIGHT COMPANY has removed its offices from Hendon to 717-723, Fulham Road, Fulham, S.W.

The business of CONSTABLE & OHLSON, armature winders, electrical and general engineers, 16, Surrey Lane, Battersea, S.W.11, will in future be carried on under the title of Constable, Ohlson & Broad, at the same address.

MESSRS. PHILIPS LAMPS, LTD., have opened a branch at Baltic Chambers, 102, Holm Street, Glasgow, C.2, with Mr. Geo. R. Jamieson as its manager, to give prompt lamp service in Scotland.

The name of VICKERS & INTERNATIONAL COMBUSTION ENGINEERING, LTD., has been changed to INTERNATIONAL COMBUSTION, LTD., and the nominal capital is being increased from £500,000 to £1,200,000. Sir Trevor Dawson has resigned the chairmanship, but is retaining his interest in the company. Mr. G. R. T. Taylor is now the chairman and managing director. Mr. George C. Usher, the general manager, and Mr. S. McEwen have been elected directors. The offices remain at Africa House, Kingsway, London, W.C.2, but the telegraphic address has been changed from "Vickomb" to "Lopulco."

Catalogues and Lists.—BECCO ENGINEERING AND CHEMICAL CO., LTD., 158-160, City Road, E.C.1.—List No. XL 15, dealing with the "Becco-Legg" water-measuring and reagent-apportioning machine for water softeners and purifiers.

SHELL-MEX, LTD., Shell Corner, Kingsway, W.C.2.—A humorous booklet entitled "The Three Hydro Carbons"—aromatic, paraffin and naphthene.

THE HART ACCUMULATOR CO., LTD., Stratford, E.15.—A coloured showcard advertising "Hart" automobile and radio batteries.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—An illustrated brochure (in French) dealing with the individual driving of machines in textile factories.

MESSRS. P. L. DWYER & CO., 30, Grosvenor Place, S.W.1.—June price list of electrical wiring materials and accessories.

THE MAGNA WIRE & CABLE CO., LTD., 137, Victoria Street, S.W.1.—A net trade price list of v.i.r. and lead-covered cables, flexible cords, &c.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, S.E.18.—Price Sheets 815 and 816, illustrating and describing respectively "Siemens" temperature recorders of the drum and continuous paper types.

TOK SWITCHES, LTD., Granville House, Arundel Street, W.C.2.—A blotter bearing a calendar for June and illustrations of rotary snap switches.

SUPERLAMP, LTD., 92 & 94, Paul Street, E.C.2.—A priced folder illustrating and describing the "Ritsema" electric suction cleaner, with particulars of a hire-purchase system.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—A fully-illustrated catalogue (Z.100) dealing with Siemens "Zed" fuses and distribution boards. Priced.

MESSRS. J. HOPKINSON & CO., LTD., Britannia Works, Huddersfield.—List No. 1,840, illustrating and describing the company's patent steam traps.

MR. ALBERT MORGAN, 138, Gower Street, W.C.1.—An illustrated booklet advertising wall cranes, pulley blocks, transporters, and other goods-handling gear.

POPE'S ELECTRIC LAMP CO., LTD., Elasta House, 5, Arthur Street, New Oxford Street, W.C.2.—A blotter with a calendar for June, advertising "Elasta" electric lamps.

For Sale.—Worcester Corporation Electricity Department invites offers for surplus d.c. motors, transformers, cast iron pipes, &c. Bingley U.D.C. Electricity Department invites offers for surplus sub-station plant. (See our advertisement pages to-day.)

Bankruptcy Proceedings.—J. H. PAINTER (trading as Venables & Co.), electrician, Cricklewood.—The public examination of this debtor was held on May 26th before Mr. Registrar Mellor at the London Bankruptcy Court, the accounts showing total liabilities of £3,185 (unsecured £1,473) and net assets valued at £533, after deducting £46 for payment of preferential claims. In the course of his evidence the debtor stated that in 1903 he and another person, with a joint capital of £50, commenced business at Cricklewood where they traded as equal partners until 1912 or 1913. Witness then paid his partner £300 by instalments for his share of the business, which he had since continued. He attributed his insolvency to bad trade, depreciation in the value of stock, loss on contracts, and insufficiency of profits to meet household and personal expenses. The examination was concluded.

J. A. REPOY (The Varley Radio Co.), 178, Ancona Road, Plumstead, S.E.18, dealer in wireless apparatus.—The first meeting of creditors was held on May 27th. The statement of affairs showed liabilities of £1,119

and a deficiency of £1,085. Debtor attributed his failure to bad management and lack of proper supervision. It appeared that he was employed in the electrical trade up to October, 1922, when he commenced business in partnership with another as the Varley Radio Co., at Eltham. His capital consisted of £8 and his partner put in no capital. In May, 1924, the partnership was dissolved and debtor took over the assets, about £300, and the liabilities, about £600, of which £326 was still owing. He then continued the business at Plumstead, and his wife had advanced about £250 to assist him. In August, 1924, he engaged a manager for the shop who was to receive 50 per cent. of the profits as remuneration. A private meeting of creditors was held on May 6th last, when a statement of affairs was presented showing liabilities of £900 and assets of £50, and an offer of 10s. in the £ payable over four years was made, but not accepted. The case being a summary one, was left with the Official Receiver as trustee. The following are creditors:—

	£		£
Arrigoni, C. & J., Ltd. ...	... 20	Hook & Willis, Ltd. ...	... 25
Behr, N.	... 130	Jackson, T. T., & Sons, Ltd.	... 255
Butcher, A.	... 20	Longford Insulating Co. ...	... 25
Dickinson Electric Co. ...	... 25	Miller & Co.	... 25
Formo Co., Ltd.	... 35	Refoy, H. H.	... 250
Godfrey, A. & W.	... 50	Szilagyi, L. F.	... 75
Greenslade & Brown ...	... 45	Scott, J. & G., & Co. ...	... 25

V. G. BAINES, electrician, 2, West Street, Wellingborough.—Receiving order made May 22nd on debtor's own petition.

J. N. DAVENPORT AND L. A. HACKETT (Davenport, Hackett and Co.), electrical engineers and contractors, 36, Spring Gardens, Manchester.—The date of the public examination at the Court House, Manchester (as per amended notice published in the *London Gazette* of May 26th), is July 10th, and not June 10th.

H. W. W. ALLFORD, wireless engineer, 13, Goldsmith Street, and 261, High Street, Exeter.—Last day for proofs for dividend, June 10th. Trustee, Mr. W. R. Cocks, Official Receiver, Exeter Bank Chambers, 67, High Street, Exeter.

J. E. BYRNE, electrical contractor, 3, Wells Yard, Waterworks Street, Kingston-upon-Hull.—Last day for proofs for dividend, June 11th. Trustee, Mr. J. E. D. Stickney, Official Receiver, 37, Scale Lane, Hull.

H. BOOCOCK (Hardwick & Co.), electrician, late of 28, New Lane, Selby.—Trustee, Mr. H. C. Bowling, Official Receiver, 24, Bond Street, Leeds, released May 21st.

A. SMITH (Smith & Gill), electrician, 57, Albion Street, Nelson, Lancs.—First and final dividend of 6d. in the £, payable June 9th, at the Official Receiver's offices, 11, Winckley Square, Preston.

H. ROGERS, electrical engineer and contractor, late of Friars Gate and Barbould Street, Warrington.—Second and final dividend of 9d. in the £, payable June 13th, at 31, Bold Street, Warrington.

J. L. R. JENSEN (Jensen & McNicol), wireless accessories factor, 149a, Seabank Road, Wallasey.—First meeting June 5th, at the Official Receiver's Offices, 11, Dale Street, Liverpool. Public examination July 15th, at the Court House, Birkenhead.

A. T. K. MOIR (Moir & Watts), electrical and mechanical engineer, Weardale Road, Lee, Kent.—First meeting June 12th, at 29, Russell Square, W.C.1. Public examination July 21st, at the Court House, Greenwich.

S. T. HOSKEN, wireless accessories manufacturer and factor, 153, Fleet Street, E.C.—Trustee, Mr. C. Latham, 15, Eastcheap, E.C., appointed May 22nd.

A. H. MILNES, electrical engineer, 48, Lidget Street, Lindley, Huddersfield.—Trustee, Mr. W. Durrance, Official Receiver, 12, Duke Street, Bradford, released May 18th.

Company Liquidations.—LEDION, LTD., radio manufacturers, Johnson Street, Westminster, S.W.1.—A meeting of the creditors of the above was held on May 26th. The chair was occupied by Mr. W. Cranstoun Todd, C.A., who had been appointed to act as the liquidator in the voluntary liquidation of the company and also as receiver on behalf of the debenture holder. The statement of affairs showed liabilities of £1,246, against assets of £526, leaving a deficiency of £720. There were debentures for £150, but there was sufficient cash at the bank to meet them, and they had therefore been excluded from the statement of affairs.

Mr. Todd reported that the company was formed towards the close of last year to take over a business which had previously been carried on by Mr. J. H. Douse and Mrs. Douse. The business was concerned with the manufacture of wireless coils and dealing in radio accessories. After the formation of the company a fairly good business was done. The directors thought that they should launch out, and money was spent pretty freely. There was an idea of developing the business in Germany, and steps were taken to obtain a provisional patent in that country to cover the name "Ledion," whilst a contract was entered into with a well-known Berlin firm. The latter was to manufacture the coils for disposal in that country, and pay a royalty to the English company. The company, however, found itself short of money, and was unable to pay its way. The books had been badly kept, and in many cases it was found that goods had been invoiced to customers which had not been sent, whilst in other instances goods had been invoiced twice over. When the company decided to develop business in Germany, money was borrowed from Mr. H. Hancocks, one of the directors, who was given a debenture for £150. On April 28th, Mr. Hancocks decided to appoint a receiver. The company had a nominal capital of £1,000, divided into 20,000 ordinary shares of 1s. each. The whole of the share capital had been issued as the consideration for the business acquired by the company. Apparently no cash was received for shares.

Mr. P. HOUSTOUN, of Messrs. Corfield & Cripwell, asked how much the company paid for the goodwill of the business acquired, and the chairman replied that he had not been able to determine what the sum was. The first directors were Mrs. L. Douse and Messrs. J. H. Douse, H. Hancocks, and C. F. Richards, but the last never acted. The principal shareholders were Mr. and Mrs. Douse, who each held 6,000 shares, and Mr. Hancocks, who was the holder of 8,000 shares.

Mr. LATHAM pointed out that Mr. Mellors had a claim under his agreement, and the amount exceeded £100. The chairman said there was a contingent liability of £200, but no claim by Mr. Mellors had been included in the statement of affairs.

Mr. TODD said that the registered trade mark, "Ledion," was of value, as the coils had been very largely advertised all over the country and were selling well, and it was anticipated that substantial profits would be received from the German contracts. If that was correct, then the creditors might hope to receive payment in full.

Eventually it was decided to confirm the voluntary liquidation of the company with Mr. Todd as liquidator, with a committee of the three principal creditors.

The following are creditors:—

	£		£
McPherson & Co., Ltd. ...	... 124	Opera Telephone Co. ...	... 23
Coquantin, M.	... 398	Stevenson & Sons	... 39
Kent Bros. Electric Wire Co.	... 26	Williams, T. H.	... 28
London Electric Wire Co.	... 234	Barclay's Advertising Co.	... 30

B.D.S. WIRELESS, LTD., Birmingham.—A meeting of creditors was held recently, at the offices of the liquidator, Mr. H. G. Willmot, Birmingham. A statement of affairs was submitted which disclosed liabilities of £1,961. The assets totalled £1,326, and from this had to be deducted £88 for preferential claims, leaving net assets of £1,239, or a deficiency as regarded the creditors of £722, and £1,972 as regarded the shareholders. It was reported that the company was registered in March, 1923, for the purpose of supplying radio sets and parts. There were four directors, three of whom took up 350 shares for cash and the fourth 200 shares. Later a further 300 shares were taken up in equal proportions by the first three. Premises were taken in Devonshire Street, the plant and fixtures being purchased for £400 from a company in liquidation. It was stated that a decline in trade commenced in January last, and as a consequence the shareholders decided upon liquidation, and appointed Mr. Willmot as liquidator. It was decided to confirm the voluntary liquidation of the company with Mr. Willmot and another as joint liquidators. A committee of inspection was also appointed, consisting of the representatives of the Devon Stamping Co., W. H. Tant & Co., the General Electric Co., Ltd., and Mr. Cripwell.

W. H. MILLER & CO., LTD., dealers in electrical appliances, Poulton-le-Fylde.—A meeting of creditors was held on May 28th, at Blackpool, when Mr. T. Greenhalgh, the liquidator in the voluntary liquidation of the company, submitted a statement of affairs which showed liabilities of £653. The assets were estimated to realise £375, less £31 for preferential claims, leaving net assets of £344, or a deficiency of £309. The issued share capital was £1,850. The liquidator reported that the company was registered in October, 1923, with a nominal capital of £2,000. There were five directors, Mr. W. H. Miller being the managing director, and he was the only member of the board who had received anything from the company. During the year to October 31st, 1924, there was a loss on the trading account of £948. The directors attributed the present position to bad trade and lack of capital. At various times the directors had advanced loans to meet pressing claims, and in respect of that money they took up shares. During the past month £450 had been paid into the company and had been used to reduce the liabilities. A resolution was passed confirming the voluntary liquidation of the company, with Mr. Greenhalgh as liquidator. The following are creditors:—

	£		£
Bankers	... 216	Coope, F. W.	... 20
Stansfield, S. F.	... 83	Lockwood, W.	... 31
Miller, W. H.	... 80	*Blackpool Gazette and Herald,*	
Poulton U.D.C.	... 41	Ltd.	... 21

WIRELESS WAREHOUSES, LTD., 37, Moreton Street, London, S.W., and at Leeds, Bradford, Hull, Stoke, Hanley, and Liverpool.—A meeting of the creditors was held on May 27th. The chair was occupied by Mr. C. Latham, who stated that the company had gone into voluntary liquidation, and had appointed him and Mr. P. S. Booth as joint liquidators.

An approximate statement of affairs showed ranking liabilities of £25,491. Of that amount £3,467 was in respect of liabilities incurred since the formation of the company on March 2nd last, whilst £22,024 was in respect of liabilities incurred prior to formation. In addition, there was a fully secured creditor for £321, who held securities valued at £600. There was a contingent liability of £7,000 none of which was expected to rank. The net assets were £17,459, leaving a deficiency as regarded the creditors of £8,032. The issued capital of the company was £5,000, and as regarded the shareholders there was a deficiency of £13,032. The contingent claim of £7,000 was in respect of bills in circulation, given by Mr. G. Busl to Darag (London), Ltd., prior to the formation of Wire-

less Warehouses, Ltd. The liquidators, after consulting with the informal committee of creditors, made arrangements to close the shops at Hull, Bradford, and Liverpool. With regard to the other shops it was thought that they should be continued for a time with a view to their disposal as going concerns.

Mr. LATHAM said that Mr. George Busl, who was of German nationality, commenced business on his own account in 1923. Later he came in contact with Mr. Edgar Gisiger, agent in this country on behalf of a big Swiss firm, who arranged for Mr. Busl to handle the firm's manufactures in this country. Subsequently Mr. Busl's business developed, and he opened a number of branches. So far as the liquidators could ascertain no payment had ever been made to Mr. Gisiger in respect of profits. Wireless Warehouses, Ltd., was registered on March 2nd last with a nominal capital of £5,000, to take over Mr. Busl's establishments for the sum of £4,998, which was satisfied by the allotment of fully paid shares. The company also undertook to pay all debts due by the vendor on February 1st last. A balance sheet was prepared as at February 1st showing capital and liabilities of £36,646. The assets also totalled £36,646. Mr. Latham said that it was undesirable at that meeting to go into details regarding the first and second debentures. It was sufficient to say that the liquidators were of the opinion that the validity of the debentures was extremely doubtful.

After discussion a resolution was passed confirming the voluntary liquidation of the company, with Mr. Latham and Mr. Booth as joint liquidators. An advisory committee was also appointed consisting of the representatives of five of the principal creditors.

The following are creditors:—

	£		£
Anglo-Swiss Press	99	Jardine, John, Ltd.	48
Autoveyors, Ltd.	30	Jacobs, R.	80
Acme Production Co., Ltd. ...	345	King, J. C., Ltd.	28
Accumulators (Birmingham), Ltd.	188	Kent Bros.	395
Bern, M.	188	Lee, A., & Co.	830
Brotchi Bros. & Co., Ltd. ...	730	Middleton, F. H.	199
British Insulated & Helsby Cables, Ltd.	109	Multiphone Terminal Co. ...	25
Clarkson, A. H., Ltd.	29	Muller & Shuer	1,218
Cables & Electrical Supplies ...	55	Macintosh & Co., Ltd.	73
Coquantin, M.	274	National Cash Register ...	90
Crowe Bros.	185	Oppenheim, J.	192
Camden Cardboard Box Works, Ltd.	48	Oldham & Son, Ltd.	210
Degnan, J. F.	38	Opera Telephone Co.	36
Darag (London), Ltd.	3,551	Pass, V. V.	40
Décolletage, S. A.	416	Phipps & Read	22
Eastick, J. J., & Sons	49	Paragon Rubber Mfg. Co. ...	142
Ebonestus Insulators, Ltd. ...	25	Penton Engineering Co. ...	21
Estick, N., & Co.	37	Royal Radio Components Co.	86
Gramostyles, Ltd.	164	Rosenberg, Paul	244
Glvavis	7,621	Radio Instruments, Ltd. ...	67
Gesiger & Beck	4,199	Radio Press, Ltd.	39
Gourvich, C. M.	66	Ridough, Frank, & Sons ...	68
Fonteyn, Gilbert & Co. ...	224	Skeldings, Ltd.	23
Green, David, & Sons	27	Stedeli, Adam & Co.	296
Hart Accumulator Co., Ltd. ...	85	Spicers, Ltd.	163
Hydeman & Co.	111	Tele-Radio Co.	20
Hosken, S. T.	25	Technon	550
Igranic Electric Co., Ltd. ...	244	Victoria Electrical Co. ...	41
J. W. B. Wireless Co.	40	Woolff, M. & S.	20
		Wilday, John, & Sons	57
		Yorkshire Electric Motor Co., Ltd.	55

A. BEHM (LONDON), LTD., radio manufacturers, 15, Cromer Street, W.C.—A meeting of the creditors of the above was held on May 26th, when Mr. W. Strachan, the liquidator, reported that the liabilities to trade creditors were about £1,600 or £1,700. The assets were insufficient to meet the claims of the debenture holder amounting to £1,500. The only assets were stock at the factory, and book debts which might produce about £100. There were preferential claims amounting to £82. Mr. Behm stated that the company was formed in July, 1924, with a nominal capital of £5,000. All along the company had been short of capital, and money was from time to time borrowed from Mr. Lovegrove, the debenture holder, who was a father of one of the directors of the company. The turnover in September last was about £1,400, but it increased in the following months. Early this year it was found that orders were falling off, and the business was unable to be run at a profit. A creditor asked why the company took a larger factory recently, and Mr. Behm replied that the lease of the old factory had run out. One of the chief causes of failure was bad debts. Mr. Behm also stated that, in addition to the money loaned on the debenture by Mr. Lovegrove, he was a creditor for a considerable sum of money besides. He had lost practically £2,000.

Eventually the meeting broke up without any resolutions being passed. The liquidation will therefore be continued with the present liquidator.

CRAIG & PATON, LTD., Belfast, electrical engineers.—A meeting of the creditors was held recently in Belfast, when the chair was occupied by Mr. Pallin, of Messrs. Buck and Hickman, of London, the largest trade creditors. Mr. John Courtney, the liquidator of the company, presented a statement of affairs which showed liabilities of £17,260, of which £13,524 was due to unsecured creditors, and the bank were partly secured creditors for £14,380, and held security valued at £10,623, leaving £3,756 to rank as unsecured. There were also fully-secured creditors for £1,876. The assets consisted of cash in hand £121; book debts, £4,034, estimated to realise £3,150; stock-in-trade, £4,172; motor vehicles, valued at £105; and fixtures, fittings, machinery, and utensils, estimated at £734, making total assets of £8,282, from which had to be deducted preferential creditors amounting to £829, leaving net assets of £7,453, or a deficiency of £9,827. The present position of the company was primarily due to depreciation in stock. In 1920, when the slump set in, the company was carrying a stock of £23,000, and that stock had since depreciated in value by almost 50 per cent. Since that date the company had consistently lost money, and in September last there was a debit to profit and loss account. The drawings by the managing directors had been at the rate of £500 per annum each. The liquidator said the directors of the company were prepared to promise the creditors 6s. 8d. in the £, and they had hopes of being able to pay that amount over a period of 10 months by a reorganisation of the business and cutting down expenses.

After some discussion the following resolution was passed:—"That this meeting is prepared to recommend the acceptance of the offer contained in the circular to creditors dated May 16th, 1925, and that a committee of the four largest trade creditors be appointed to work with Mr. John Courtney, the liquidator, until the composition has been paid, and that this meeting be adjourned until the date of the next meeting proposed to be called under the order of the Court."

The following are included in the list of creditors:—

	£		£
Buck & Hickman, Ltd. ...	1,100	Electrical Installation & Repairing Co.	52
British Thomson-Houston Co., Ltd.	455	Automatic Telephone Manufacturing Co., Ltd.	43
Hurst Electrical Plant, Ltd. ...	405	Loudon Bros., Ltd.	41
Vickers, Ltd.	355	Crossley Bros.	39
General Electric Co., Ltd. ...	252	Western Electric Co.	39
British Insulated & Helsby Cables, Ltd.	202	Stewarts & Lloyds, Ltd. ...	36
Ulster Electrical Federation ...	151	Macintosh Cable Co., Ltd. ...	35
Stevens, A. J., & Co. (1914), Ltd.	137	Radio Instruments, Ltd. ...	33
Drummond Bros., Ltd. ...	110	Marconiphone Co., Ltd. ...	30
Igranic Electrical Co., Ltd. ...	77	Pope's Electric Lamp Co., Ltd.	28
Brown, S. G., Ltd.	25	Tucker, J. H., & Co., Ltd. ...	28
Johnson & Phillips	24	Walsall Hardware Manufacturing Co., Ltd.	27
Empire Radio Co.	24		

EAST ANGLIAN ELECTRICITY, LTD., The Broadway, Felixstowe.—A meeting of the creditors was held recently at Ipswich. The liquidator, Mr. C. P. Dawes, reported that the meeting had been called for the purpose of discussing the reconstruction of the company. The whole of the debts of the company would be paid in full. The terms of the reconstruction, so far as they affected the creditors, were explained, and the creditors being satisfied with his explanation no resolutions were passed. Accordingly the liquidation remains in the hands of Mr. C. P. Dawes.

Private Arrangements.—S. C. RAPSON, L. C. BURRILL, AND A. J. HEFFER, trading as the Suburban Electrical and Maintenance Co., 2, Plough Yard, Shoreditch, E.C.—A meeting of the creditors of the above was held recently at the offices of Messrs. Corfield & Cripwell, when Mr. W. A. J. Osborne submitted a statement of affairs which showed liabilities of £2,683, of which £1,663 was due to the trade, and £1,020 to cash creditors. The assets were estimated to realise £814. From this figure had to be deducted £85 for preferential claims, leaving net assets of £729, or a deficiency of £1,954. It was stated that the cash creditors were relatives, who were willing to retire their claims to the extent of £520. A full set of books had not been kept. The partners started trading in the early part of 1922, and figures prepared in March, 1923, covering the first year's trading, showed a small loss. It appeared that a serious loss was sustained on a contract entered into with the Office of Works. A resolution was passed in favour of the matter being dealt with under a deed of assignment, with Mr. Osborne as trustee.

F. A. SMITH, wireless engineer, High Street, Stourbridge.—A meeting of the creditors of the above was held recently, when the statement of affairs presented showed liabilities of £2,523, made up as follows:—Trade creditors, £1,523; cash creditor, £500; and bank overdraft, £500. The assets totalled £1,005 9s., but from this had to be deducted £11 for preferential claims, leaving net assets of £994, or a deficiency of £1,529. It was stated that the debtor commenced with a capital of £150. Proper books of account had been kept, and at the end of 16 months' trading he had made a loss of £1,900. That loss was largely due to depreciation in the value of stock. During the following eleven months there was a profit on the trading of £1,100, but since February of the present year there had been a loss of £260. During the first 16 months the turnover was £2,800, but in the following eleven months it went up to £6,400. The drawings had been small. An offer was made of a composition of 7s. 6d. in the £, payable in cash, which it was unanimously decided should be accepted.

Lighting Service Bureau at Glasgow.—The Electric Lamp Manufacturers' Association proposes to open a lighting service bureau at Glasgow so that continuous demonstrations can be given of the correct methods of lighting, and the Electricity Committee recommends a donation of £100 towards the expenses and a free supply of electricity.

The Bribery Prevention League and the Radio Business.—At the recent annual meeting of the Bribery and Secret Commissions Prevention League, the president (Lord Lambourne) said that they were seeking to secure the support of the wireless trade—a comparatively new industry into which bribery had found its way. Sir Charles Bright said, however, that he did not understand where there was any scope for bribery with regard to wireless. Mr. Longman suggested that some good might be done if an address on the objects of the League was broadcast.

A Battery Service Label.—THE RAY MANUFACTURING CO., 350, Fishponds Road, Bristol, has sent us a sample of its "Symplist" battery label. This is for use in battery service depôts, where it is attached to accumulators when they are brought in. Space is provided for details of charging, replenishing acid and water, and reparation, as well as a tear-off receipt form and an acknowledgment of the leaving of the battery.

Austrian Foreign Electrical Trade.—In a review of a report by the British Commercial Secretary at Vienna, the *Board of Trade Journal* states that there was a marked increase in the quantities of machinery, and electrical and radio apparatus exported from Austria during 1924. On the other hand the exports of electric lamps decreased.

New Belgian Companies.—The Philips Radio Belge S.A. has been formed in Brussels (37, rue d'Anderlecht), with a capital of 500,000 fr., for the manufacture and sale of X-ray and radio apparatus.

The Accumulateurs Gaulois, which has recently been constituted with offices at 389, Chaussée de Mons, Anderlecht-Brussels, with a capital of 120,000 fr., has as its principal object the manufacture and maintenance of accumulators. It will also undertake electrical installations and the supply of automobile accessories.

The Construction Electrique et Automobile (Beaumont), has been recently formed with a capital of 450,000 fr. for the manufacture and sale of electric motors and electrical apparatus.

The Société Tirlemontaise d'Electricité (127, rue du Marché, Brussels), a newly-formed company, with a capital of three millions fr., proposes to erect power stations and install tramways in the Tirlemont district.

Local Exhibitions.—MIDDLESBROUGH.—An Ideal Homes Exhibition was held at Middlesbrough from May 6th to 16th. An excellent display of silk electric lamp shades and other electrical accessories was shown by Mr. Cecil Ridley, a local electrical and radio factor.

MANCHESTER.—The Manchester *Daily Dispatch* is organising a Clean, Pure Food and Cookery Exhibition at the City Exhibition Hall from June 5th to 20th. The Manchester Electricity Department is to demonstrate electric cooking during the run of the exhibition.

United States Electrical Exports.—According to *Commerce Reports* the figure of $7,720,406, representing the total value of electrical exports during March, was the highest monthly total since June, 1921, and about 13 per cent. above the monthly average for 1924. As compared with March, 1924, when the total was $7,572,920, there was a considerable decrease in the exportation of a.c. and d.c. generators, which was not quite off-set by the rise in the value of steam-turbine generating sets. The increase in the total, as compared with March, 1924, appears to have been due to a decided increase in accessories and parts for generators. There were substantial increases in self-contained lighting outfits, primary batteries, rectifiers and converters. Decreases occurred in the exports of transformers, electric locomotives, and storage batteries. So far as motors were concerned there was an increase in the exports of the smaller sizes, but a decided decline in the case of larger machines. A fall in the exportation of domestic heating and cooking apparatus was compensated for by an increase in fans and other motor-driven household appliances. Radio apparatus showed a further substantial increase.

Salaries of Commercial Electrical Staffs.—The Blackburn Electricity Committee has turned down an application by the Electricity Supply Commercial Association for the adoption of its "standard scale of salaries" in connection with the electricity commercial and clerical staffs.

Book Notices.—"Year Book of Wireless Telegraphy and Telephony, 1925." London: *The Wireless World*. Price 15s. net.

"*Journal* of the South African Institution of Engineers." Vol. XXIII, No. 10. May, 1925. Price 2s.

"Science Abstracts" (A and B). Vol. XXVIII, Part 5. May 25th, 1925. London: E. & F. N. Spon, Ltd. Price 3s. each net.

Technologic Paper of the United States Bureau of Standards. No. 279, "Testing of Fireclay Bricks with Special Reference to Their Use in Coal-fired Boiler Settings." By R. F. Geller. Price 20 cents.

Scientific Paper of the United States Bureau of Standards. No. 501, "Specific Heat of Superheated Ammonia Vapour." By N. S. Osborne, H. F. Stimson, T. S. Sligh, and C. S. Cragoe. Price 15 cents.

Knowles Electrolytic Plant for the Pyrenees.—We are informed that what is thought to be the largest contract of this kind ever placed has been signed by the Société des Phosphates Tunisiens, of Paris, with the International Electrolytic Plant Co., Ltd., of Chester. It is for an installation of 600 standard Knowles cells, each having a capacity of 7,500 amperes. The contract price is £63,300. The installation will produce by electrolysis of water over 70,000 cubic feet of hydrogen and 35,000 cubic feet of oxygen per hour. The hydrogen is for the newly formed "Société des Engrais Azotes et Composes," whose present capital of 76,000,000 francs is held by the "Société des Phosphates Tunisiens," of Paris, and the "Norsk Hydro-Elektrisk Kvaelstofaktieselskab," of Christiania. The works are at Soulom in the French Pyrenees, near Lourdes. The whole of the hydrogen will be used in the manufacture of synthetic ammonia.

Proposed New German Tariff.—With the *Board of Trade Journal* dated May 28th was published a translation of the new Tariff Revision Bill which has recently been submitted to the Reichsrat (Stationery Office, 6d.). The technical work in connection with this is so great that it is considered improbable that it can be carried into effect until at least two months after its promulgation. An all-round increase is proposed, and in the section relating to electro-technical apparatus the increase, generally, is very large. For instance, the duty on dynamos for automobiles and for starting i.c. engines is raised from 9 to 150 gold marks per 100 kg. The duties on other dynamos and motors are greatly increased for the smaller sizes, but the addition falls with the increased size of the machines. The duty on Röntgen tubes is raised from 60 to 2,000 M. per 100 kg. Telegraph and telephone apparatus is subjected to double the present duty, *i.e.*, 120 M per 100 kg., and the duty on cables is also doubled, making it 16 M per 100 kg.

For Sale.—Aldershot Borough Council Electricity Department has for disposal surplus generating plant, superheaters, condensers, cooling tower, &c. (See our advertisement pages to-day.)

Copper, Lead and Rubber Prices.—Messrs. F. Smith and Co. report, June 2nd:—Copper (electrolytic) bars £61, 5s. increase; ditto ditto sheets, no change; ditto ditto wire rods £74, 5s. increase; ditto ditto h.c. wire, no change.

Messrs. James & Shakespeare report, June 2nd:—No change in the prices of copper bars (best selected), sheet and rod; English pig lead £34 10s., 10s. increase.

Messrs. Edward Till & Co. report, June 2nd:—No change in para and gutta-percha prices.

Stoker Contracts.—We have received from Messrs. E. Bennis & Co., Ltd., a list of contracts which they have recently received for stokers and other boiler-house plant and accessories. These include coal-handling and storage plant for the Borough of Torquay's Newton Abbot power station; sprinkling stokers, self-cleaning compressed air furnaces for Lancashire boilers, feeding equipment, &c., for the Bridlington Corporation power station; ash-handling plant for the Cardiff Corporation's Roath power station; sprinkler stokers, &c., for the Macintosh Cable Co., Ltd., and Siemens Bros. & Co., Ltd.; and orders from firms in many industries at home and abroad.

A.E.U. Conference.—The annual meeting of the National Committee of the Amalgamated Engineering Union was held at Southport last week. Mr. J. T. Brownlie, in the course of his presidential address, said that the union had lost many members, but on the other hand, there were 8,500 fewer unemployed members than a year ago. He deplored the emigration of thousands of skilled engineers to the countries of our competitors. Mr. Brownlie referred to the recent wages negotiations and said that the Union had definitely set its face against the extension of working hours. Later in the meeting a resolution was passed calling upon the Government to provide suitable work for skilled mechanics at full trade union rates, and instructing the executive to approach the engineering and allied employers to bring pressure upon the Government to secure the ratification and observance of the findings of the Washington Convention with regard to working hours.

British Trade Mark Applications. — The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from May 27th:—

Radionite (lettering and design). No. 453,939. Class 8. Detector crystals for radio-telephony and telegraphy.—C. G. Williams, trading as the British Radio Manufacturing Co., 9, South Castle Street, Liverpool.

Hart-Collins, Ltd. (lettering and design). No. 459,983. Class 8. Complete sets and outfits for use in radio-telegraphy and telephony.—Hart-Collins, Ltd., 38a, Bessborough Street, Westminster, S.W.1.

Alterna Vox. No. 457,907. Class 8. Radio-telegraphic and telephonic apparatus.—La Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz, 12, Place des Etats Unis, Montrogue (Seine), France. (British representatives: Mewburn, Ellis & Co., 70-62, Chancery Lane, W.C.2.)

Alpine Sun. No. 456,043. Class 13. Electrical fittings and lamp standards.—John Bell & Croyden, Ltd., 50-52, Wigmore Street, W.1.

Ruco. No. 457,160. Class 50. A material for electrical insulating purposes, &c.—The Ruberoid Co., Ltd., 296-302, High Holborn, W.C.1.

British Switchgear for the Canadian Market.—The Winnipeg correspondent of the *Manchester Guardian Commercial*, writing on May 11th, stated:—"Mr. J. G. Glassco, manager of the Winnipeg hydro-electric system, informed me to-day that he was much impressed by samples of British high-tension switches and switch gears recently submitted to him by a representative of a British firm. These are manufactured for export, as the British fuel-electric stations do not use this kind of equipment. Mr. Glassco stated that the prices compared most favourably with those of Canadian and American makes, while the protection they afforded operators through their closed-in character excelled anything he had so far seen produced on this continent. At the present moment negotiations are in progress between the Winnipeg Hydro and the Winnipeg Electric Company, which operates the local tramway system, besides conducting a light and power business, for a delimitation of their respective spheres of operation, and for the tying-in of the power generated at their respective power-plants on the Winnipeg River. Should these negotiations mature, Mr. Glassco stated, a large order would have to be placed for high-tension switches and switch gear and he promised that every consideration would be given to British producers. He saw no reason in the world why such equipment as that submitted should not command a market all over the American continent."

Lighting and Power Notes.

Accrington.—YEAR'S WORKING.—The report on the working of the Town Council's electricity undertaking for the past year shows a total income of £76,179, as compared with £74,372, and working expenses of £38,585, as against £37,865 in 1923-24. The profit for the year was £14,487, compared with £12,838. Of this, £4,718 was appropriated for various purposes, including £2,000 for rate relief, leaving a net profit of £9,834, against £11,168 in the preceding year. The total energy sold was 13,901,583 kWh, an increase of 1,708,713 kWh.

Argentina.—ELECTRICAL DEVELOPMENT.—During the past year the electric power station at La Plata belonging to the River Plate Electricity Co., Ltd., was taken over by the Compania Hispano-Americana de Electricidad. The station has now 36,224 consumers, and in view of the increasing demand further plant is being added. The company is also in negotiation with the municipal authorities of La Plata with reference to a new concession.

Aylesbury.—HIRE OF ELECTRIC COOKERS.—The Town Council has applied for sanction to a loan of £6,000 for the purchase of electric cookers to be let out on hire.

Barking Town.—ELECTRICITY IN BULK.—The Urban District Council has appointed a committee to interview the Electricity Commissioners regarding a bulk supply of electricity.

Blackburn.—OPPOSITION TO ORDER WITHDRAWN.—The Rural District Council has withdrawn opposition to the application of the Lancashire Electric Power Company for an Order to supply electricity in the Council's area, the company having given assurance that the maximum price of 10d. per kWh mentioned in the Order would not be charged. Clitheroe Rural District Council has also withdrawn its opposition to the Order.

Brighton.—LOANS.—The Town Council is applying for sanction to a loan of £45,000 for mains and services. Sanction has been received to a loan of £14,450 in connection with the supply of electricity to the Southwick Urban District Council.

Cheadle and Gatley.—ELECTRICITY CHARGES.—The Urban District Council has adopted a flat rate charge for electricity used for heating purposes of 2½d. per kWh for the first 50 kWh used each quarter and 2d. per kWh beyond.

Chesterfield.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £14,000 for mains and services.

HIRE OF DOMESTIC APPARATUS.—In addition to the hiring-out of cookers at 5s. per quarter, including an electric kettle, the Electricity Committee has decided to hire out electric fires of any size up to 3 kW inclusive at 3s. 6d. per quarter. The charge for electricity for domestic purposes was fixed at 1d. per kWh as from March 31st last.

EXTENSION OF SUPPLY.—A petition has been received from residents in the New Whittington area asking for a supply of electricity, and a scheme is to be prepared to deal with their requirements.

Continental.—BELGIUM.—La Société du Chemin de Fer Electrique d'Ostende-Blankenberghe et Extensions, whose power station is at Slykens, has secured the concession from the Western Flanders Provincial authorities for the supply of electrical energy for lighting and power purposes in the Bruges district and in the war-devastated areas of the province.

GERMANY.—The Berlin correspondent of the Exchange Telegraph Company states that owing to the increasing demand for electricity in Berlin the city authorities propose to construct a new large central power station with a capacity of 216,000 kW by the summer of 1927, rising to 400,000 kW by the winter of 1929. It is estimated that, with the new machinery and equipment, a saving of 40 per cent. in coal consumption can be effected to the end of 1926. The cost is estimated at 30,000,000 marks. These works will be erected in Berlin, and later another large power station will be built outside the city.

It is reported that during the past six months the Berlin municipal electricity works has received 400 to 500 requests daily for new connections, the majority being received from industrial concerns.

SPAIN.—La Sociedad Electra del Viesgo has applied for Government approval to a scheme to establish a 95,000-V electric power transmission line to connect its stations at Urdom and Carmens *via* Penarrubia, Tresviso and Cabrales (Province of Oviedo).

Our special correspondent in Spain reports that it is proposed to increase the 15,000 h.p. installation owned by the Electra de Viesgo to 40,000 h.p. During the past year this company has completed the central station of Santa Cruz de Ujo, at the mouth of the coal mines of the Hullera Española. Additional plant and machinery have also been installed in the stations of Astillero, at Santander. A complement of 2,500 h.p. now serves as a reserve for the seven installations which the company has in Santander, Asturias and Palencia.

Crewe.—EXTENSION OF SUPPLY.—The Corporation has agreed to supply the Nantwich Urban District Council and the Nantwich Rural District Council with electricity at the same price as it supplies its own consumers, plus the cost of transmission, and application is to be made for a Special Order authorising the Corporation to supply electricity to an area extending ½ mile beyond the limits of the borough.

Dalkeith.—PURCHASE OF UNDERTAKING.—The Town Council proposes to exercise its option under the Dalkeith Electric Lighting Order, 1901, to purchase the local electricity undertaking of the Electric Supply Corporation, Ltd., and has offered the company £17,000.

Dewsbury.—POWER STATION FLOODED.—Owing to recent heavy rains, which caused certain becks to overflow, the fire brigade had to be summoned to pump water from the condensing pit at the Corporation electricity works. Three motors in the works were submerged and were out of action for two or three days, but one machine was unaffected and it was possible to continue the supply to the town.

Dumfries. — INAUGURATION OF EXTENSIONS. — Extensions which have recently been carried out at the Corporation electricity works were formally inaugurated on May 28th. The new plant consists of a 750-kW turbo-alternator, manufactured by Messrs. Belliss & Morcom, Ltd., and the Lancashire Dynamo & Motor Co., a 500-kW rotary converter and a new switchboard by the Metropolitan-Vickers Electrical Co., and a Sterling 15,000-lb. water-tube boiler. The cost of the scheme was £25,000, and the capacity of the plant is now 1,400 kW.

Glasgow.—PROGRESS DURING APRIL.—During April the Corporation Electricity Department completed the wiring of 99 houses, bringing the total to date to 831, while additional fires and cookers totalling 112 were let out on hire.

Lytham-St. Annes.—ELECTRICITY CHARGES.—From July 1st next the Town Council is adopting a two-part system, consisting of 20 per cent. of the rateable value of a house, plus 1½d. per kWh. Electricity for all purposes has been reduced by ½d. per kWh.

Indo-China. — ELECTRICAL DEVELOPMENT. — According to *Eastern Engineering*, the Société Indo-Chinoise d'Electricité, in its recently-issued report, states that new agreements have lately been concluded for the supply of electricity to the towns of Hanoi and Haiphong, and that to meet the increasing demand an additional 1,500-kW turbo-generator is being installed and a contract arranged with the Société Industrielle de Chimie d'Extrême Orient for a supplementary supply from the latter's power station. To deal with this a new main is at present being laid and a 300-kW converter installed. The Indo-Chinoise Co. has also secured concessions to establish generating stations in the towns of Nain Dinh and Haiduong, and a contract for one in Laokay, together with the reorganisation of the existing distribution system in the last-named town.

London.—BATTERSEA.—The Electricity Committee has passed plans prepared by the borough electrical engineer for the erection of a sub-station in Lavender Hill and has recommended that the work be carried out at a cost of £3,905.

As a result of representations made to the Ministry of Health, the Council has received a intimation from the Ministry that no objection will be raised to the Council's proposal to install electric cookers in houses on the Plough Road housing estate, provided that no part of the cost of the installation will rank for financial assistance.

Loughborough.—ELECTRICITY EXTENSIONS.—Mr. R. Leach, the borough electrical engineer, has recommended that the following extensions be carried out at the electricity works:—New boiler, £5,970; forced draught stoker, £2,900; super-imposed super-heater, £1,630; coal handling plant, £6,800; ash-handling plant, £3,160; cable, £2,290; with a number of smaller provisions, the whole amounting to £25,901. The Electricity Committee has recommended that the whole of the extensions, with the exception of the coal and ash-handling plant be proceeded with immediately.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

BINGLEY.—Heating purposes: From 1½d. to 1¼d. per kWh.

CREWE.—A general reduction of 10 per cent.

BELFAST.—Power.—Maximum demand system: 6d. per kWh for the equivalent of 182 hours' use per half year of the maximum demand and ½d. per kWh thereafter. Any demand over 10 kW and not exceeding 300 kW: For a d.c. supply—£3 10s. per kWh of maximum demand, plus .5d. per kWh consumed. For an a.c. supply—£3 3s. per kVA plus .5d. per kWh consumed. Flat rate: From 5½d. to 4½d. per kWh.

EASTHAMPSTEAD.—*The Ascot District Gas and Electricity Co.*—Electricity for all purposes reduced by ½d. per kWh.

Plymouth.—MAINS EXTENSIONS.—The Electricity Committee has decided to lay additional mains at an estimated cost of £6,400.

ELECTRICITY AGREEMENT.—The Committee has recommended that an agreement be entered into with the Admiralty and War Department for a period of five years ending March 31st, 1930, for the supply of electricity by the Corporation to the Government establishments.

Shipley.—ELECTRICITY AGREEMENT.—At a recent meeting of the Urban District Council, the chairman of the Electricity Committee reported that the committee had had under consideration the agreement with the Yorkshire Electric Power Company for a bulk supply from the Bradford Corporation mains to supplement the supply from the Council's works, and that satisfactory terms had been arranged.

Shoeburyness.—ELECTRICITY SCHEME.—The Vickers & International Combustion Engineering Co. recently informed the Urban District Council that, provided it can obtain the support of local authorities, it intended to establish on the south bank of the River Crouch a power station to supply electricity to surrounding districts. The firm asked the Council to support the scheme. It was decided to seek the observations of Southend Town Council on the matter.

Special Orders.—Application has been made for a Special Order by Major C. H. B. P. Westcar, of Herne, authorising him to supply electricity in certain parishes in the rural districts of Salisbury, Fordingbridge, and Wimborne and Cranborne, and by the Burton-on-Trent Town Council, for the supply in the urban district of Swadlincote, the rural district of Tutbury, and parts of the rural districts of Repton, and Hartshorne and Seals. The Electricity Commissioners have submitted to the Minister of Transport for confirmation an Order made by them for the supply by the Exeter City Council in certain parishes in the rural district of St. Thomas.

Stoke-on-Trent.—ELECTRICITY EXTENSIONS.—The Corporation Electricity Committee has decided to provide a new feeder to supply the central area of Burslem at a cost of £8,000, to lay an e.h.p. main to Victoria Road, Tunstall, and to erect a sub-station at a cost of £5,000.

Tunis.—ELECTRICAL DEVELOPMENT.—The report of the Compagnie des Tramways de Tunis states that the capacity of the power station is to be increased by a new 6,400-kW turbo-alternator. During the year work was completed on the laying of a new underground 10,000-V distributing main between the Tunis-Marine transformer station and La Pepinière.

United States.—ELECTRICAL DEVELOPMENT IN NEW YORK.—According to the *Electrical World*, the general design of the large generating station which is to be erected by the New York Edison Co. at Fourteenth Street and the East River, and will be known as the East River station, has recently been announced by Thomas E. Murray, Inc., the designing engineers. The station is laid out for an initial installation of 120,000 kW and for an ultimate capacity of 700,000 kW. The main plant will include the initial installation of two 60,000-kW, 25-cycle, 11,400-V General Electric turbo-generators. In addition, a 40,000-kW, 25-cycle, 11,400-V, 60-cycle, 13,800-V General Electric frequency changer will be installed in the turbine room. Ten 1,550-h.p. Springfield water-tube boilers equipped to use pulverised fuel will furnish steam for the first turbine installation. All main auxiliaries will be steam-driven. In future installations some of the boilers and turbines may be of the mercury type. The exact size and rating of these have not been definitely decided. Seven more steam turbines, each of 60,000 kW or larger, are contemplated. It is probable also that another 40,000-kW frequency changer will be installed when a demand for greater interchange of power with the 60-cycle system occurs. The new station will be interconnected with the 25-cycle system of the Edison-United companies by underground transmission lines of 11,400 V. The pressure of the 60-cycle side of the frequency changer will be 13,800 V, and this voltage will be raised to 27,600 V by transformers to connect by means of underground transmission lines with the Edison-United 60-cycle systems, the Brooklyn Edison and other outside systems.

Willesden.—LOANS SANCTIONED.—The Urban District Council has received sanction to borrow £10,000 for transformers, and £16,405 for mains.

Tramway and Railway Notes.

Blackburn.—YEAR'S WORKING.—The accounts of the Corporation tramway undertaking (general manager: Mr. J. H. Cowell) for the year ended March 31st last record a total revenue of £116,752, as compared with £115,130 in the preceding year. Working expenses amounted to £86,338, as against £87,712, leaving a gross profit of £30,414 (£27,418). After payment of capital charges and contributing £6,000 to permanent-way renewals fund, there was a net surplus of £14,128, as compared with £10,699 in 1923-24. The number of passengers carried increased from 15,904,168 to 16,456,553, but the car-mileage fell from 1,119,050 to 1,116,468.

Continental.—FRANCE.—The General Council of the Jura is constructing two new lines of local electric railways in the department which, when completed, will be operated by the Compagnie Générale des Chemins de Fer Vicinaux.

Work is well in hand on the electrification of the Bordeaux-Hendaye railway, and it is expected that the first section between Bayonne and Hendaye will be completed this month and the remaining section early next year. To supply the necessary power three generating stations are being established, the current being transmitted at 150,000 V to sub-stations at Dax, near Bayonne, and Pessac, near Bordeaux.

La Société Electrique Lille-Roubaix-Tourcoing has secured government approval to the extension of its electric tramway between Roubaix and Toufflers to the Belgian frontier at Festingue and so provide a connection with the Belgian local railway system.

ROUMANIA.—Mr. Tancred Constantinescu, Minister of State, is reported to have stated that the Government has received an offer from a foreign group with regard to the electrification of the Roumanian railways, with the co-operation of foreign capital. The offer has been accepted in principle, and representatives of the group are shortly expected to arrive in Bucharest.

BELGIUM.—According to the report of the Société Nationale des Chemins de Fer Vicinaux, of Brussels, for last year, the company is preparing for considerable extensions of its local electric railway system in the Borinage and Centre districts and also in the Charleroi, Ghent, Courtrai, Louvain, and Namur areas. During the year several electrified sections were opened in the Antwerp and Brussels district, while work is well in hand on the electrification of the Dilbeek-Schepdael-Eyseringen and Grimberghen-Humbeek lines. Plans are also in hand for the electrification of the Grimberghen-Londerzeel line, and for one between Meysse and Laiken.

Darlington.—RAILLESS CARS.—The Electricity and Light Railways Committee has recommended an extension of the railless-car system through Cockerton to Faverdale works entrance, West Auckland Road; from Eastbourne to the new road; and the Barton Street route to Haughton-le-Skerne.

India.—RAILWAY ELECTRIFICATION.—*Indian Engineering* reports that the Bengal-Nagpur Railway authorities have in view a scheme of electrification of their suburban passenger system. No definite decision has been arrived at yet, and the matter is being kept in abeyance until the whole question of the suburban traffic of Calcutta has been co-ordinated and reported on to the Railway Board by Mr. Legge. If Mr. Legge takes a favourable view of the matter, it is intended to introduce electrification between Calcutta and Khargpur—roughly a distance of 37 miles. The proposal is to lay a double track within this area and work the passenger trains on this track by electricity. If necessary, other feeder lines will be constructed. The present lines will remain intact and will be used for all long-distance traffic.

It is proposed to electrify the Kolar Gold Field Railway from the Bowringpet junction to the Gold Field, about 10 miles in length, of the Madras and Southern Mahratta Railway Co. With a hydro-electric power system and transmission lines already in operation, the proposal is highly practicable if the requisite capital is forthcoming. The approximate capital cost would be a total of Rs. 4 lacs, and if the cost of the disengaged steam locomotives be deducted, the net cost would, be Rs. 2,20,000.

London.—PROPOSED NEW TUBES.—According to the *Daily Telegraph*, it is anticipated that the public inquiry into the advisability of constructing three new tubes in North and East London will be held in about two months' time. The routes of the proposed tubes have not yet been discussed in detail, but one request is for an extension of the Finsbury Park Tube to the North. Another is for a tube running along the south of the Thames towards Woolwich; and the third is for a tube running north-east, from the neighbourhood of Aldgate, towards Walthamstow.

Rotherham.—YEAR'S WORKING.—The past year's working of the Corporation tramway department has resulted in a combined net profit of £13,494, as compared with £17,033 in the preceding year. The profit on the tramway amounted to £10,081, as against £18,236, and the loss on the railless-car system has been reduced from £2,662 to £8, while the profit on the petrol buses has been increased from £1,459 to £3,421.

Telegraph and Telephone Notes.

Hull Telephones.—YEAR'S WORKING.—The financial result of the telephone service for the past year has been placed before the Hull Corporation Telephones Committee, says the *Financial Times*. It is the only municipal service in the United Kingdom, and Hull enjoys lower tariffs than any other city in the country. The gross profit amounted to £33,991 and the net profit was £10,077. The royalty paid to the Government was £10,950, and since the commencement of the undertaking the total paid in royalties to the Government has amounted to £107,510.

The Telephone Service.—STATISTICS.—Last year nearly 1,000,000,000 telephone calls were made in this country. Of the total mileage of working wire on December 31st last, 78 per cent., or 3,330,157 miles, was underground. The over-head mileage was 946,211. The number of individual telephones increased from 176,857 in 1900 to 1,243,621 in 1925, giving one telephone to every forty-seven of the population. In the same period the number of stations in America increased from about 850,000 to nearly 16,000,000, which gives one telephone to every seven of the population.

U.S.A.—LARGE TELEPHONE EXCHANGE.—Housing under its roof more telephone equipment than is found in some entire European countries, and sufficient to supply the service needs of a city the size of Cincinnati, the new building of the New York Telephone Co. now being constructed will contain six local central offices to serve downtown Manhattan and one central office for toll traffic, making it the largest and most complex switching exchange centre in the world, says *T. & T. Age*. The building will be 29 stories in height and a large part

of it will be ready for occupancy early in 1926. It is to be used both as a central office and administrative headquarters for the company. Along its walls and through its floors there will be more than 164,000 miles of wire; seven of its floors will each cover an acre in area, while in the four sub-basements will converge a total of more than 400 lead-covered cables, containing 693,000 separate wires.

Radio Notes.

Australia.—POLITICAL SPEECHES.—Mr. Bruce, Commonwealth Prime Minister, disapproves of the broadcasting of political speeches by "A" class stations, which receive a portion of the licence fees, but, says *The Times*, he does not object to their being radiated by "B" class stations, which draw no subsidy.

B.B.C. Revenue.—The amount collected in fees for broadcast licences up to March 31st was about £1,240,000, and the amount paid to the British Broadcasting Co. to date is £922,000.

Canada.—TAXATION OF SETS.—There are over 100,000 amateur radio sets in use in Canada to-day, on each of which an annual tax of one dollar is levied, though not always paid, irrespective of the value of the set. The suggestion has been made in the House of Commons that there should be a graduated tax, proportionate to the value of the sets, which range in price from 1.50 dollars to 1,000 dollars, or even more. —*Reuter* (Ottawa).

Irish Free State.—BROADCASTING POLICY.—The Free State Government's radio broadcasting policy was outlined in the Dail on May 27th by Mr. J. J. Walsh, Postmaster-General, who stated that the Minister of Finance had agreed that the service should be conducted by the State. It was intended to establish the main station in Dublin and a subsidiary one in Cork; the installation cost was estimated at £9,000, and the "mechanical" upkeep and cost of the programme at £20,000 per year. It was hoped that in the third year the station would be able to pay its way. There were 20,000 subscribers in Northern Ireland.

South Africa.—FEES BY INSTALMENTS.—An interesting, if rather elaborate, system by which listeners' fees are paid by instalments has been introduced in the Union. By an arrangement between the postal and the broadcasting authorities, listeners may pay a first instalment of 15s. and the remainder in three monthly instalments of 10s. each. Of the whole sum, 5s. goes to the Government and £2 to the Cape Peninsula Broadcasting Association. According to *The Times*, this concession has been found practically essential with so high a fee as £2 5s.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Australia.—HOBART.—June 30th. Tasmanian Hydro-Electric Department. Material for and erection of an 88,000-V transmission line of 59 miles from Waddamanna to Railton.

MELBOURNE.—July 1st. Victoria Railways. Electric cable.*

June 15th. City Council. H. and l.p. 3-phase sub-station switchgear.—*Reuter's Trade Service* (Melbourne).

SYDNEY.—August 5th. New South Wales Railway Commissioners. Two ash conveyors for the White Bay power house.

Ayrshire.—Education Authority. Electric lighting in connection with special school and clinic at Saltcoats. Schedules from Mr. W. Reid, Master of Works, Education Offices, Ayr.

Belgium.—July 8th. Société Nationale des Chemins de Fer Vicinaux, 14, Rue de la Science, Brussels. Underground electric cables in connection with the electrification of the Brussels-Hal and Brussels-Espinette-Waterloo local railways. Particulars (5 fr.) from Bureau des Services Electriques, 48, Rue Montoyer, Brussels.

June 13th. Service de l'Electricité de la Ville de Liége. Armoured cables required during 1925-26. Particulars (5 fr.) from Bureau Administratif des Services Industriels, Annexe de l'Hotel de Ville (1er Etage), Liége.

Bredbury.—Bredbury and Romiley Urban District Council. Transformers and switchgear. (May 22nd.)

Bristol.—June 16th. Electricity Department. One 1,000-kW rotary or motor-converter. (May 22nd.)

Coventry.—June 8th. Education Committee. Electric light installation at various schools. Mr. F. H. Harrod, Director of Education.

Darlington.—June 30th. Electricity Department. One 6,000-kW turbo-alternator, condensing plant, and two 40,000-lb. per hour water-tube boilers. (See this issue.)

Dumfries.—Installation of electric lighting at Ewart Public Library. Specifications from W. F. Crowbie, architect, 151, Irish Street, Dumfries.

East Ham.—June 13th. Education Committee. Installing electric light at Hartley Avenue and Sandringham Road schools. Mr. F. R. Thompson, secretary. (Returnable deposit of 10s.)

Eccles.—June 29th. Electricity Committee. One 1,300-kVA Scott-connected transformer group. (See this issue.)

Egypt.—CAIRO.—Inspecting Engineer to the Egyptian and Sudanese Governments, Queen Anne's Chambers, London, S.W. 24,350 kilos copper wire and rods.—*Reuter's Trade Service.*

Hawarden.—June 11th. Electricity Department. L.p. underground cables and fittings. (See this issue.)

Hull.—June 18th. Electricity Department. Two 7,000-kW turbo-alternators and condensing plant. (May 29th.)

Idle.—June 13th. Installation of electric lighting of Upper Chapel, Idle, the schools and manse. Specifications can be inspected at the caretaker's (Mr. Brearley, Westfield Lane, Idle). Tenders to Mr. T. H. Bedford, 10, Cross Road, Idle.

India.—June 9th. India Store Department. Three 120-kW, d.c., direct-coupled Belliss generating sets; 100-kW rotary converters, with transformers and starting gear. (May 22nd.)

June 23rd. Six electric Scotch derrick cranes, 25 and 10 tons.

Keighley.—The Board of Guardians is inviting tenders for the installation of electric light in a number of buildings at the St. John's Hospital and at the Central Home of the Guardians.

Leeds.—June 15th. Education Committee. Electric lighting of schools. Specifications from Architect's Section, Education Department, Calverley Street.

London. — HOLBORN. — June 10th. Board of Guardians. Electrical installation at the hospital, Archway Road, N. (May 22nd.)

HAMMERSMITH.—June 12th. Electricity Department. One water-tube boiler, with mechanical stoker, feed pump, piping, &c.; two centrifugal pumps, strainers, valves, pipework, &c. (May 22nd.)

STEPNEY.—June 24th. Board of Guardians. Electrically-driven lift and building work in connection with the same. (See this issue.)

WESTMINSTER.—June 17th. Board of Guardians. Supply of 21 British Ericsson auto-reset-type 25-line telephone instruments or other approved instruments at the Board's offices. Mr. W. J. Lickey, clerk to the Guardians, Guardians' Offices, Princes Row, S.W.1.

Manchester.—June 9th. Electricity Committee. Stores required during the 12th months ending June 30th, 1926. June 12th. Cable required during 12 months ending June 30th, 1926. Specification and forms of tender from Mr. S. L. Pearce, manager, Electricity Department, Town Hall.

June 16th. Cast or wrought steel pipes and flanges, Stuart Street station; centrifugal oil purifier, Barton power station. (May 29th.)

Normanton.—June 27th. Electric lighting installation at the Boys' Grammar School. Specifications from Mr. T. R. Robinson, Clerk to Governors, Technical School, Normanton.

Sleaford.—June 12th. Electricity Department. Two 300-b.h.p. crude oil engines with auxiliaries; two 200-kW d.c. generators; one 2-ton hand-operated overhead crane; switchboard and switchgear. (May 22nd.)

South Africa.—JOHANNESBURG.—Municipal Council. June 20th. 6,600-V cable.*

PRETORIA.—June 17th. Union Tender Board. Supply of wireless telegraph equipment for wireless stations at Pretoria and Salisbury, Southern Rhodesia. Specifications and forms of tender from the Controller of Stores, G.P.O., Pretoria.

CAPE TOWN.—June 22nd. Electricity Department. Pole line hardware, insulators, bare copper wire, tubular poles and insulated wire.*

Southend-on-Sea.—Light Railways and Electricity Department. Traction storage battery. (May 29th.)

Spain.—SANTANDER.—June 20th. Junta de Obras del Puerto de Santander. Three goliath cranes.

Stoke-on-Trent.—June 9th. Electricity Department. L.p. switchgear. (May 22nd.)

Tunbridge Wells.—July 8th. Electricity Committee. One 3,000-kW turbo-alternator, with condenser, piping, and cables, one cooling tower, steam piping, &c. (See this issue.)

Turkey.—STAMBOUL.—July 7th. Posts and Telegraphs. 365 tons of iron wire, 2 tons brass wire, and 5,000 copper couplings.*

Walthamstow.—June 15th. Education Committee. Electric lighting installation at the Selwyn Avenue School, Highams Park. (May 29th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Aberdeen.—Electricity Committee. Accepted:—
New boiler-house plant for the electricity station (£61,000).—Babcock and Wilcox, Ltd.

Australia.—MELBOURNE.—Victorian Electricity Commission. Accepted:—
Lead-covered and armoured cable (£17,000).—British Insulated & Helsby Cables, Ltd.
6,600-V transformers and spares (£15,160).—Thomas Bros. Pty., Ltd.
35-ton electrically-operated travelling crane (£1,835).—Noyes Bros. Pty., Ltd. (Melbourne).—*Reuter's Trade Service* (Melbourne).

Birmingham.—Corporation housing scheme.
10,000 "Phlatta" switches; 2,700 fuse units, 10 amp., S.P.; 5,000 S/C and C/G lampholders; 20,000 wood blocks, 3 in. by ⅛ in.—Edison Swan Electric Co., Ltd.

Brighton.—Tramways Committee. Accepted:—
Six D.K. 40-h.p. traction motors (£198 per motor, £1,188).—English Electric Co., Ltd.

Electric Lighting Committee. Accepted:—
New switchboards for 460-V d.c. supply at North Road:—

General Electric Co., Ltd. (Accepted.)	**£2,890**
Bertram Thomas	2,698
Metropolitan-Vickers Electrical Co., Ltd.	3,040
British Thomson-Houston Co., Ltd.	3,146
Crompton & Co., Ltd.	3,520
Naider Bros. & Thompson, Ltd.	3,907

Burnley.—Board of Guardians. Accepted:—
Dynamo and generating set.—Metropolitan-Vickers Electrical Co., Ltd.
Engine.—Bellias & Morcom, Ltd.

Chesterfield.—Electricity Department. Accepted:—
Superheaters for 3 water-tube boilers (£1,200).—Babcock & Wilcox, Ltd.
Alterations to coal bunkers.—Plowright Bros., Ltd.
Cable.—Macintosh Cable Co., Ltd. (£683); Western Electric Co., Ltd. (£381).
5,000 tons blast furnace coke breeze.—Staveley Coal and Iron Co., Ltd.
Transformer.—Brush Electrical Engineering Co., Ltd.

Coventry.—Corporation. Accepted:—
Transformers (£5,624).—British Electric Transformer Co., Ltd.
Switchgear (£802).—Metropolitan-Vickers Electrical Co., Ltd.
Cable (£8,404).—Pirelli-General Cable Works, Ltd.

Dundee. — Education Works Committee. Recommended:—
Installation of electric light in schools.—A. Fyall & Co., John Smith, Moncrieff Bros., A. Westwood & Co., and Mr. D. J. Macdonald. Total amount of tenders, £1,790.

Erith.—Urban Council. Accepted:—
Cable in connection with housing schemes (£1,228).—Callender's Cable and Construction Co., Ltd.

Glasgow.—Health Committee. Accepted:—
Electric lighting installation, &c., Mearnskirk Sanatorium (£3,020).—Malcolm & Allan, Ltd.

Lighting Committee. Accepted:—
One mile of cable (£199).—W. T. Glover & Co., Ltd.

Electricity Committee. Recommended:—
Air preheater installation at Dalmarnock power station (£2,518).—Howden-Ljungström Preheaters (Land), Ltd.

Stores for six months:—
Cast-iron boxes, section pillars, &c.—Carron Co.; Falkirk Iron Co., Ltd.; Lion Foundry Co.; McDowall, Steven & Co., Ltd.
Malleable iron tubes and fittings.—Stewarts & Lloyds, Ltd.; the Scottish Tube Co., Ltd.

Tramways Committee. Recommended:—
Commutators for 49B motors.—P. R. Jackson & Co., Ltd.
Lead-covered h.p. and feeder cable.—Western Electric Co., Ltd., and Siemens Bros. & Co., Ltd.
Copper bonds.—British Insulated & Helsby Cables, Ltd.
Lead-covered telephone cable.—Western Electric Co., Ltd.

Housing Committee. Accepted:—
Electric installation at Mosspark and Riddrie Bowling and Tennis club-houses.—McLean & Robb.

Gravesend.—Town Council. Accepted:—
Condensing plant (£4,668).—Worthington Simpson, Ltd.

Ilford.—Electricity Committee. Accepted:—
Electrical supplies.—Electrical Supplies Co., Ltd. (agents for Deutsche Kabelwerke A.G., of Berlin). The tender was £1,531 less than the lowest English tender.

Halifax.—Tramways and Electricity Committee. Accepted:—
Supply of vertical pumping set at electricity works (£242).—Holden and Brooke, Ltd.

Leeds.—Electricity Committee. Accepted:—
Cables.—Enfield Cable Works, Ltd. (£3,034); W. T. Henley's Telegraph works, Ltd. (£2,846); Macintosh Cable Co., Ltd. (£1,076); Hackbridge Cable Co., Ltd. (£622).

London.—LONDON COUNTY COUNCIL.—Education Committee. Recommended:—
New battery at residential school, Homerton:—

Tudor Accumulator Co., Ltd.	498
Alternative	521
Chloride Electrical Storage Co., Ltd. (Recommended.) ...	**585**
Alternative	539
Pritchett & Gold and E.P.S. Co., Ltd.	510
Edison Swan Electric Co., Ltd.	510
D.P. Battery Co., Ltd.	513

Electric lift at School of Printing, Lambeth:—

Medway's Safety Lift Co. (Recommended.)	**£200**
Express Lift Co., Ltd.	390
Waygood-Otis, Ltd.	450

LONDON, MIDLAND & SCOTTISH RAILWAY.
5,000 "Osram" vacuum train-lighting lamps.—General Electric Co., Ltd.

WESTMINSTER.—Highways Committee. Accepted:—
5-h.p. electric motor, for Salvage Department.—Elliston, Evans & Jackins, Ltd.

POPLAR.—Electricity Committee. Recommended:—
Motors for boiler plant, &c. (£989).—General Electric Co., Ltd.
Two motors for coal-handling plant (£225).—Veritys, Ltd.
Motor starters (£1,750).—Brookhirst Switchgear, Ltd.
Two ventilating fans.—J. Keith & Blackman Co., Ltd.
Two outdoor transformers (£2,040).—Metropolitan-Vickers Electrical Co., Ltd.

Sidmouth.—Electricity Committee. Recommended:—
Extension of overhead mains on Salcombe Hill (£422).—Gilbert Gilkes and Co., Ltd.

Sowerby Bridge.—Housing Committee. Accepted:—
Electrical work in connection with the housing schemes.—Gath Electrical Engineering Co.

Forthcoming Events.

Faraday Society and the Iron and Steel Institute.—Monday, June 8th. At the Institution of Civil Engineers, Great George Street, S.W. From 3.30 p.m. to 7.30 p.m. Joint discussion on the "Physical Chemistry of Steel-making Processes."

Exhibition of Inventions.—Central Hall, Westminster, S.W. June 8th to 13th, inclusive.

Institution of Electrical Engineers.—Tuesday, June 9th, to Friday, June 12th. Summer meeting at Birmingham.

National Association of Supervising Electricians.—Tuesday, June 9th. At the Junior Institution of Engineers, 39, Victoria Street, S.W. At 7 p.m. Third Annual Competition for the W. E. Highfield Shield.

Roentgen Society.—Tuesday, June 9th. At 32, Welbeck Street, W. At 8.15 p.m. Ordinary scientific meeting.

Association of Mining Electrical Engineers.—Tuesday, June 9th, to Saturday, June 13th. Summer meeting at Cardiff.
Friday, June 12th. At the South Wales Institute of Engineers. Joint meeting with the Western Centre of the Institution of Electrical Engineers. Paper, "Electricity in Mines," by Major E. I. David.

Radio Society of Great Britain.—INFORMAL MEETING.—Wednesday, June 10th. At the Institution of Electrical Engineers, Victoria Embankment, W.C.I. At 6 p.m. Discussion on "The Application of the Supersonic Method of Reception to Ultra-short Waves Lengths," to be opened by Mr. W. K. Alford.

Notes.

Correspondence.—A correspondent, whose letter does not appear in this issue, is requested to forward his name and address.

Social Event.—A departmental dinner and musical evening was held by the staff and employés of the Woolwich Borough Council electricity undertaking at the "Shakespeare" Hotel, Woolwich, on May 23rd. Mr. S. H. Penning, deputy borough electrical engineer, presided, and he was supported by the Mayor (Councillor J. Newman, J.P.). Councillor T. Davis (chairman of the Electricity Committee), Alderman T. Watt (vice-chairman of the Electricity Committee), Councillors V. Lister, H. Sykes and J. A. Turnbull, Mr. G. W. Keats (borough electrical engineer), Messrs. L. C. Chasteauneuf, F. H. Edwards (chief electrical engineer, Dartford), and F. F. Eliott (station engineer). Among the guests were a number of ex-members of the staff. Mr. G. R. Smith (clerk to the Electricity Committee), proposed the toast of "Woolwich Electricity Undertaking." In the course of his speech Mr. Smith said that from a position of continual loss the undertaking had been lifted to a position of success and profit and quite recently the undertaking had contributed £12,000 to the relief of the rates. He referred to the large supplies now being given to the Bexley and Erith areas and also the pioneer work which had provided the first "all-electric" house in this country. Electricity, once termed the rich man's luxury, was now the working man's necessity. Councillor T. Davis responded to the toast. Councillor J. A. Turnbull proposed the health of the "Borough Electrical Engineer," who entered the Council's service in 1900, and took over his present duties. He said that during the past year the Woolwich undertaking had reduced its works costs and it was now one of the best in London. He asked Mr. Keats to accept from the whole of the staff and employés of the undertaking, a gold watch, as a token of their esteem, and in celebration of his 25th year of service and 20th as borough electrical engineer. Mr. G. W. Keats in responding, said that it was team work that had pulled the undertaking through. Mr. A. E. Nicholl, distribution department, proposed the toast of the "Woolwich Borough Council," and the Mayor responded. Mr. C. E. Margerison, sales manager, then made a presentation to Mr. J. Earl, wireman, on his retirement on completion of 22 years with the department. Mr. Earl briefly responded. Mr. S. H. Penning proposed the toast of "The Guests," and this was replied to by Mr. F. H. Edwards. Mr. T. W. Bunce proposed a vote of thanks to the committee which had organised the function, and Mr. Smith replied. An excellent musical programme was provided.

(*Continued on page 903.*)

The Southern Railway Electrification.—II.*

The Rolling Stock Equipment: G.E.C. Electrical Gear.

THAT portion of the Southern Railway's electrified suburban area which was inaugurated on April 1st, comprising the Norwood Junction and Balham to Sutton and Coulsdon North section of the system, was formerly

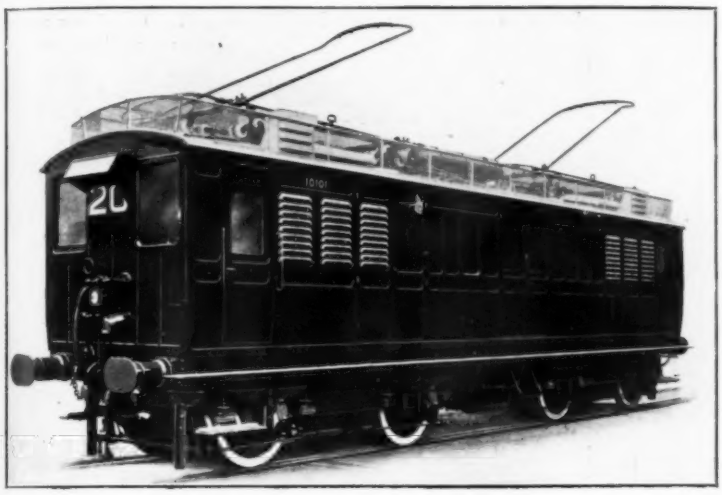


Fig. 1.—"Southern" Motor Coach.

part of the L.B. & S.C.R., and it should be pointed out that the contracts for the electrification equipment were placed and the work commenced before the railway grouping scheme was carried out. Prior to the grouping, it was the settled policy of the L.B. & S.C.R. to electrify its line as far as Brighton, and accordingly in the preparation of the scheme as a whole and in the design of the motor and trailing coaches that eventuality had to be provided for.

A 25-cycle single-phase system is employed, and the lay-out of the whole scheme and the preparation of the specifications were carried out by Sir Philip Dawson, K.B.E., consulting engineer; Mr. Herbert Jones is the

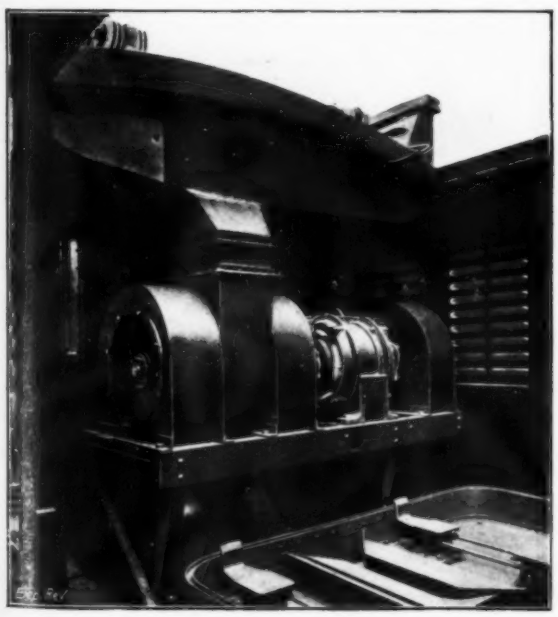


Fig. 2.—Motor-Driven Blower and Transformer Base.

chief electrical engineer to the Southern Railway. The complete electrical equipment for the 21 motor coaches, 60 driving trailer coaches, and 20 trailing coaches has been supplied by the General Electric Co., Ltd. The 25-cycle, single-phase electrical system employed, coupled with the fact that many new features have been embodied in the design and lay-out of the apparatus, adds considerable interest to the equipment.

Each train is built up on the multiple unit principle, one motor coach being provided for each train unit, which contains all the electrical apparatus required; that is, apart from control equipment on driving trailer coaches, control lines, lighting equipment, &c. The motor coach contains no accommodation for passengers, the space, apart from that occupied by apparatus, being allotted for the guard's van (fig. 1), and it can be controlled from both ends, so that in effect it becomes almost a locomotive capable of running in either direction at either end of a train without need for turning round; also it can be used for hauling ordinary non-electrical coaches. The make-up of a train unit at present consists of five coaches, the motor coach being in the middle, with three driving trailer coaches and one ordinary trailer coach.

Fig. 3.—H.P. Chamber, showing Main Oil Switch, H.P. Fuses, and Earthing Switch.

The provision of an additional driving position allows flexibility in train formation, and during the rush-hour periods two 5-coach trains are coupled together. The equipment of a motor coach is duplicated at each end, with the exception of the air compressor, so that in case of a fault in one section, the coach can still be

*The first article appeared in the April 10th issue.

operated by the other. The control gear is of the "all-electric" type.

The current is collected from the overhead lines by duplex bow collectors, one for each section, which provide for running in either direction by the raising of the appropriate bow. The movement of the bow is

Fig. 4.—Lowering Main Transformer into Coach.

controlled automatically through a valve by the reversing contactors, which are operated from the master controller in any driving position. The springs which maintain the pressure of the bow are entirely insulated from current-carrying parts, so that if they break no short circuit to the car roof is possible.

From the collector gear the current passes to the main oil switch *via* choke coils and two high-pressure fuses, one to protect the motor section of the gear and the

Fig. 5.—Motor and Pinion; Commutator Cover Removed.

other the auxiliary apparatus. The oil switch (seen in fig. 3) is provided with interlocks and overhead releases in the form of a separate relay. The main and auxiliary transformers and preventative coil are all contained in an oil tank, which is cooled on the outside by forced draught from the blower (shown in fig. 2 and referred to later). It is interesting to note that the equipment has proved so satisfactory that the blower has only had to be used to a very limited extent. The main transformer (fig. 4 shows one being lowered into a coach) has four tapping points which, with the preventative coil, give seven running notches, and, in conjunction with the motor characteristic, give very smooth acceleration. The auxiliary transformer is provided with suitable tappings for supplying the blower motors, compressors, control, and lighting.

Reversing is accomplished by means of four interlocked contactors, and acceleration is obtained with a further set of seven contactors fitted with the necessary interlocks; these are in duplicate for each section. All the contactors are of a similar type and operated by single-phase solenoids.

There are two motors per section, *i.e.*, four in all, of the single-phase, series-compensated type, with interpoles; they are self-ventilating, but external forced ventilation is also provided from the motor-driven blower (fig. 2). The maximum continuous specified rating with external forced ventilation is 200 b.h.p. at a speed not exceeding 34.7 m.p.h. One-hour ratings were also specified, namely, 225 b.h.p., without external

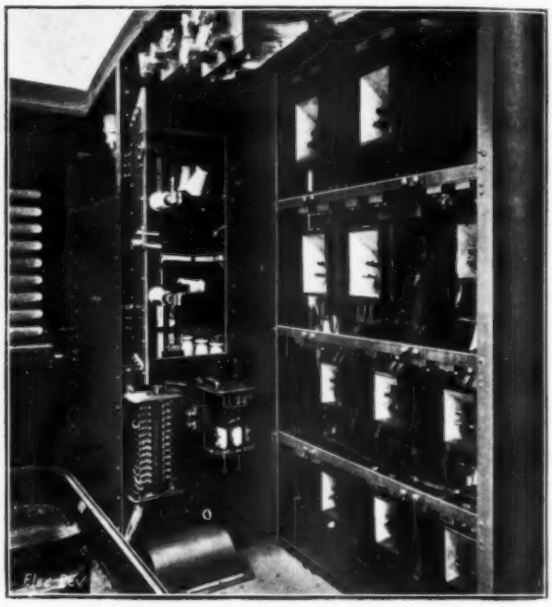


Fig. 6.—Contactors, H.P. Chamber, and Overload Relay.

forced ventilation at a speed not greater than 32.0 m.p.h. and 250 b.h.p. with external forced ventilation at a speed not above 30.5 m.p.h. The ventilation is on a double parallel-flow system, and the motors were designed to exclude all dust, oil, and moisture. The

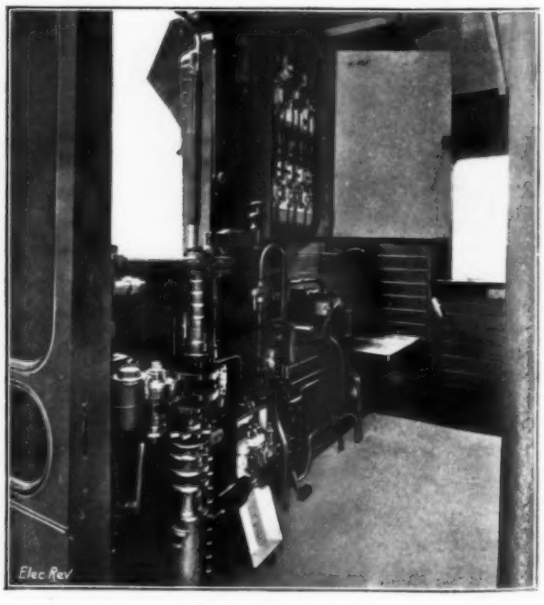


Fig. 7.—Driver's Cab.

stator core fits in the main case tightly, but is self-contained, so that it can be pressed out of the case as an independent unit when required. The waste method of lubrication is employed. The brush holders are of

the "pistonic" type developed by the consulting engineer, and have renewable brush boxes, while the brushes are accessible and wear evenly. Fig. 5 illustrates a motor, and fig. 8 a bogie.

Further equipment includes two motor-blower units, one for each section, also one compressor motor for brake equipments, with governor and the necessary control gear. Fig. 2 indicates that the blower motor drives three fans, one for each motor in the section and one for the transformer tank. The blowers can be controlled from any driving position that is in operation on the train.

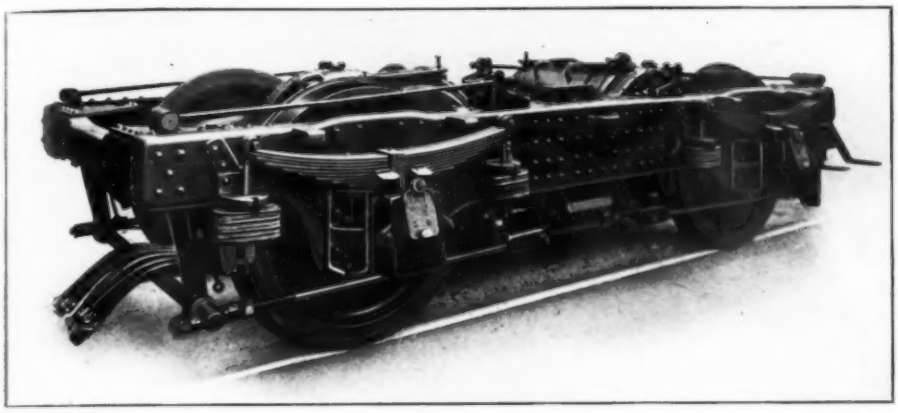


Fig. 8.—Motor Bogie.

On the ends of the coaches are mounted duplicate control receptacles and an auxiliary receptacle, while jumpers are provided for joining up the trailer coaches. There is a master controller at each end of the motor coach for controlling all the motors throughout the train, in addition to the master controller on the driving trailer coaches. These have seven positions, are compact, and are provided with the usual "dead man's handle."

The general lay-out of the equipment in the coach is as follows: The bow collector is mounted directly above the bogies (see fig. 1), while directly below it is the small h.p. chamber (shown in skeleton in fig. 3), in which are situated the oil switch and main and auxiliary fuses. The doors of this chamber are so interlocked that they will only open when the apparatus within is dead and earthed. The main transformer is situated directly on the main cross members of the frame which rest on the bogie; it is, however, slightly out of centre so as to allow an unobstructed gangway from one end of the coach to the other. The l.p. connections from the transformer to the main contactors are run overhead in the apparatus compartment, the contactors (fig. 6) being mounted in groups and screened by removable sheet steel covers.

At each end is a driver's cab (fig. 7) containing the usual control gear, consisting of a master controller, driver's brake and emergency valves, with switches for the control of the auxiliary apparatus and train lighting, and such miscellaneous gear as small lighting and control contactors, the guard's switch and lever regulator.

A Modern Electric Motor Works.

A Visit to the Empress Works, Huddersfield, of Messrs. E. Brook, Ltd.

DURING a recent visit to the "Empress" works we were able to study an example of a modern factory constructed, equipped and managed with a view to high output and efficiency. The firm of E. Brook, Ltd., which celebrated its 21st anniversary with a visit of the staff and workpeople to Llandudno on June 3rd, has enjoyed a long period of steady progress. The founding of the firm was the result of a desire of Mr. E. Brook, the head of the firm, to make single-phase motors, and having done so, to satisfy the fair criticisms of Mr. Lunn, of the Huddersfield Corporation Electricity Department, who tested Mr. Brook's first motor. On May 30th, 1904, the first factory was started in Threadneedle Street, Huddersfield, for the purpose of making single-phase motors and starting gear. On August 10th, 1905, the business was converted into a private limited company, under the style of E. Brook, Ltd. In November, 1905, as a result of increased business, the factory was removed to larger premises in Colne Road. The manufacture of three-phase motors and switchgear was commenced in June, 1906, and the business which resulted from the sale of these motors was such that in October, 1915, it was decided to build the present factory, the site being on the bank of the River Colne at "Dead Waters"—one of the few flat spots of Huddersfield within the free-delivery railway area. The new works were established in May, 1917, and permit of the making of electric motors in sizes up to 300 h.p. and up to 100 motors of various sizes per week. The

Fig. 1.—Machine Shop.

machinery is arranged so as to provide for easy progress of all materials through the factory without causing congestion.

With the exception of the casting, the whole process of manufacture of the motor is carried out in one room, the machine shop. This extensive room, around which the offices, foundries, stores and dining rooms, &c., are

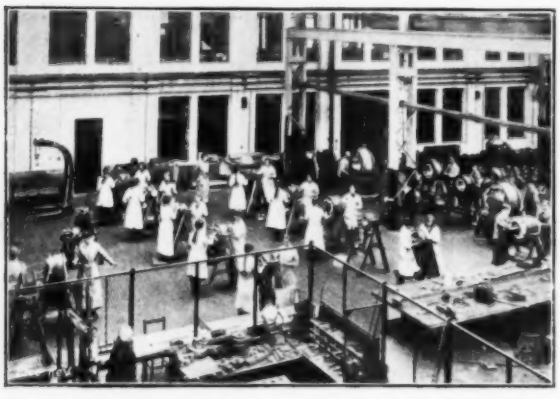


Fig. 2.—Winding Department.

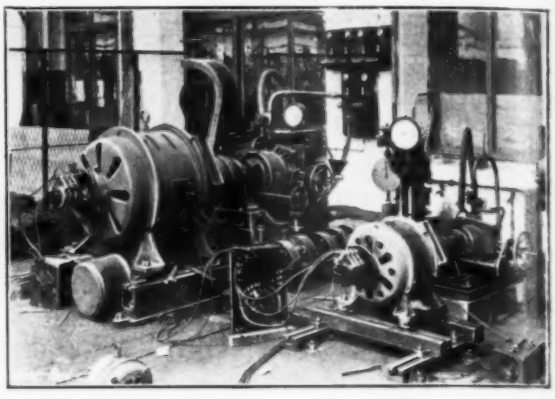


Fig. 3.—Corner of Testing Department.

built, has a floor area of 3,013 square yards, and is arranged in four main bays, each bay being spanned by an electric travelling crane. The roofs are of steel construction and are covered with rough plate glass; the height from the floor to the ridge is 36 ft. The floor is covered with tongued and grooved boards on coke breeze concrete. The machinery is arranged in rows down the length of the room in such a way that in the process of manufacture the various motor parts can be passed either to the store or to the assembling department without in any way interfering with other work that is being carried on at the many machines close by. This, in view of the compactness of the whole equipment, does credit to those who were entrusted with the lay-out of the machinery. The assembling is done in one of the centre bays, the various parts being made on one side, and the final operations, testing, painting, &c., effected on the other. The winding is done at one end of the building, ample floor space being provided for this process.

Fig. 4.—Assembling Bay.

The accompanying illustration, fig. 1, shows the machine bays, where practically the whole of the machine work is done. The frame castings and stampings are received at the near end and passed down the bays in the process of manufacture to the far end, where the winding is done. The frame castings are first bored and keyed for the stampings, which are then assembled under pressure. The stators are next ground out and then wound, having by this time reached the winding department, shown in fig. 2. The wound rotors are passed through a similar process to that of the stators, the shafts first being turned and keyed for the cores. In the case of the squirrel-cage rotors, it is interesting to note the method of joining the copper bars and the brass end rings. The copper bars are first assembled in the mould, at nearly melting temperature, and the molten brass for the end rings is poured round the ends of the hot copper bars, the result being complete metallic union.

Fig. 4 is a view of the centre bay or assembling department. At the far end is the store for the finished parts, the completed motors being stored in the bay on the left, where the motors are painted and finished off.

The foundries are situated outside the main building at the far end, but only brass and aluminium casting is now done on the premises. The iron castings, stampings, and the ball-bearings are received from an outside source, but otherwise the whole of the parts which constitute the complete motor are machined and assembled in the factory. The wire used for the windings is all impregnated before it is used on the motors, an impregnating plant being installed outside the main premises. Each motor is tested on load before it leaves the factory.

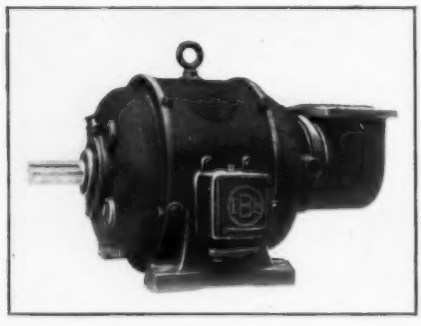


Fig. 5.—Totally Enclosed Slip-ring Motor.

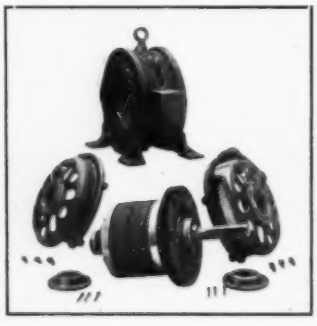


Fig. 6.—Parts of Brook Protected-type Squirrel-cage Motor.

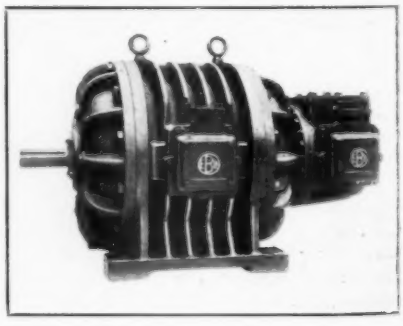


Fig. 7.—Totally Enclosed Mine Motor.

The testing is carried out in a separate and fully equipped testing department, which is part of the left bay (fig. 3). A supply of electricity is received from the Corporation mains at 50 cycles, and is distributed to the various static transformers and motor generators by means of which the various pressures and frequencies which have to be catered for are obtained. The testing department is equipped with two Heenan and Froude hydraulic brakes. Under test each motor is subjected to a severe overload till the temperature is increased by 72 deg. F. It is then put on the normal full load, and is expected to cool down. A Helsby condenser is installed for the improvement of the power factor of the supply. The manufacture of the motor starters is carried out on the second floor of the offices block. The winding of the no-volt and overload release coils is done by means of American winding machines leased from the makers. The coils are impregnated in a separate apparatus in this department.

Credit is due to this firm for some bold schemes of works management, which, of course, are designed with efficiency as the objective, but in which the human element is most marked. All employés are paid an ordinary wage, which is supplemented by a bonus scheme on production and not on profits. A bonus is paid to every employé for each given piece of work which is carried out satisfactorily as the result of good workmanship. As a further stimulus to good handicraft, in many cases penalties are enforced for unsatisfactory production. A tester receives a given bonus for each motor which he tests out in a satisfactory manner, but should he damage a motor by the application of a wrong pressure to its coils, then he is subjected to a fine equal to the bonus which he would have received had his work been satisfactory. Even the boy responsible for the return of packing cases is paid under this bonus with penalties scheme.

Automatic intercommunication telephones are installed for communication between any of the offices and workshop departments. A system of low pressure water heating is installed throughout the whole of the premises.

Dining rooms with excellent service are run by the firm, and the employés can sit down to an excellent two-course meal each day for about the sum of 10d. A canteen is run in conjunction with the dining rooms, the profits from which are used to help to keep the cost of the employés' meals at a low figure.

The social side of the lives of the employés is not overlooked. Whist drives, &c., are organised periodically, and workshop competitions are arranged for on the sports fields.

Not least in importance is a training scheme which the firm has adopted. Boys are first employed for duties in the various departments, and those who show marked ability are indentured as apprentices, and are given opportunities for special training in the engineering departments, the drawing offices, or the commercial departments. Attendance at evening classes is one condition of employment for boys.

In conclusion, it is interesting to note that up till May 21st the firm had 10,000 designs of electric motors to its credit, and had completed the manufacture of over 39,000 motors. Figs. 5, 6, and 7 illustrate some of the firm's products. Fig. 5 depicts a totally-enclosed crane slip-ring motor; fig. 6 shows a protected type squirrel-cage motor, dismantled; and fig. 7 illustrates a totally-enclosed mine motor.

Women's Conference at Wembley.—An important conference of women engaged in science and industry will be held at the British Empire Exhibition from July 15th to 17th. The societies participating are the Women's Engineering Society, the Industrial Welfare Society, the Institute of Industrial Welfare Workers, the National Union of Scientific Workers, the Standing Joint Committee of Industrial Women's Organisations, and the Women's Electrical Association. A number of papers will be read covering a wide variety of subjects, including welfare work, commerce, chemistry, engineering, and salesmanship. Miss M. Partridge, B.Sc., will read a paper on "The Domestic Application of Electricity."

Notes.

(*Continued from page 898.*)

Electric Clocks at Sea.—It is interesting to note that the newly-built Cunard liner, *Ascania*, which recently ran her trial trip successfully, has been fitted throughout with "Pul-syn-etic" clocks, the special feature being that they are all linked together and are electrically driven and controlled by a master clock that is fitted with a chronometer escapement, in place of a pendulum, as for land use, and also with an automatic advance and retard mechanism, so that the vessel's time shall conform with local noon wherever she may be. With the patent advance and retard mechanism it is only necessary to set a pointer on a dial within the master clock to the required number of minutes and press the advance lever, when all the clocks are automatically advanced, and by pressing the retard lever, the clocks are all retarded. This system, by Gent & Co., Ltd., dispenses with the need of visiting each individual clock for the purpose of daily setting. The sister ships *Aurania*, the *Ausonia*, and the *Alaunia* are also fitted with the "Pul-syn-etic" clock system, as well as 20 other Cunard vessels, including the *Aquitania*.

Electricity Supply Rifle League.—The prize meeting was held on May 23rd, at the Hackney Club range. The weather was fairly good, though some of the competitors found fault with the cross wind. There were two dozen competitors drawn from the affiliated clubs. The arrangements for the meeting were in the hands of the hon. secretary of the League, assisted by Mr. H. V. Hows, hon. secretary of the City Company's club, Mr. C. P. Fox, hon. secretary of the St. James' Club, and Mr. Holliday, of the County Company's club. The 25-yd. scratch shoot was won by Mr. H. V. Hows (City); the 50-yd. match was won by Mr. A. J. Beale (Central); and Mr. A. A. Pitcher (Shoreditch), was first in the 100-yd. scratch competition. Mr. G. Wright (Central) secured the championship cup.

Appointment Vacant.—Working electrical engineer for the Hawarden Rural District Council. (See our advertisement pages to-day.)

Women's Electrical Association: Change of Name.—At a recent meeting of the Council of the Association it was decided to change the name in order to avoid confusion with the initials of the Workers' Educational Association, and it will in future be known as the Electrical Association for Women, with the initials E.A.W. The Association is taking part in the I.M.E.A. special meeting for women at the Brighton Convention. It is also arranging a special session on electricity at the conference of women to be held at Wembley on July 17th.

Brass Furnace Data.—A correspondent points out that a very small percentage of the brass foundries in this country has adopted the electric furnace in place of the common pit type coke furnace or the gas furnace, and there is a wide field to be exploited by the makers of electric furnaces if melting costs can be reduced. There are many advantages of electric melting, such as more accurate temperature control, cleanliness, and the melting of the metal in a reducing atmosphere, which are worth something; but the foundry industry as a whole has not yet realised that direct fuel costs are not everything. Some interesting figures were published recently by an American concern that remodelled a 105-kilowatt furnace, converting it to a 240-kilowatt unit. This was accomplished by cutting the shell of the old furnace on a line with the top of the door and placing a self-supporting resistor unit of 300-kilowatt capacity on the furnace. To obtain the additional electrical capacity, two of the former 105-kilowatt transformers were connected in parallel on the secondary side.

Since this type of resistor unit is self-supporting, the usual piers for trough support were eliminated and a new hearth, composed of grain magnesite and open-hearth slag, was sintered into place. The elimination of piers allowed an increase in hearth capacity from 1,500 to 3,200 pounds. The capacity and energy consumption of the furnace before and after remodelling compare as follows:—

	Before remodelling.	After remodelling.
Average heats per 24 hr.	8.15	10
Weight per charge, lb.	1,560	3,066
Time per heat, hours	2.93	2.4
Hourly capacity, lb.	500	1 328
KW-hours per ton	447	308
KW-hours per ton, including heat up over Sunday	503	330

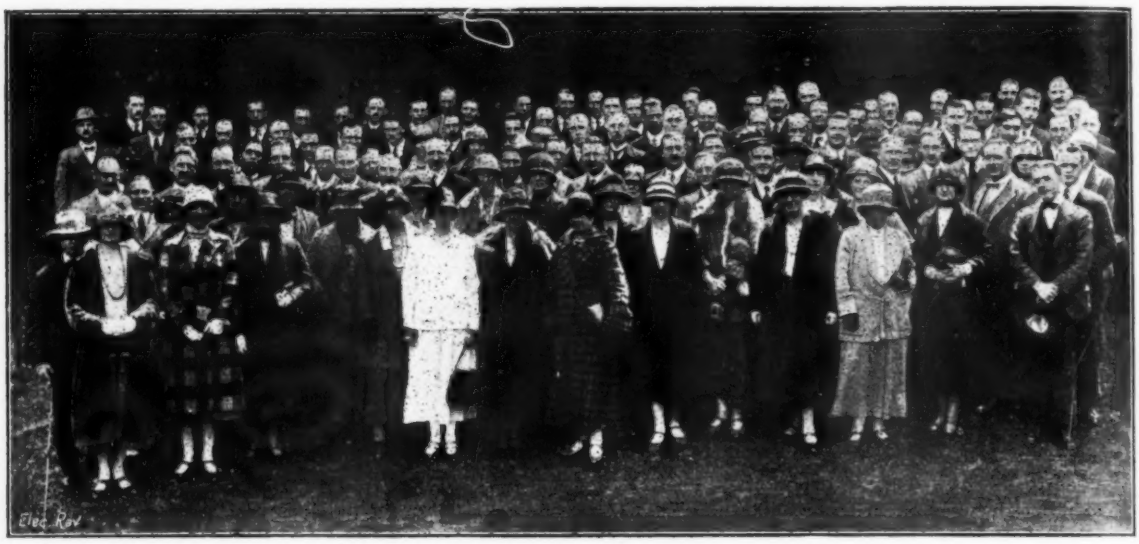
These figures were based on 24-hour operation on substantially the same analysis of metal, namely, approximately 70 per cent. copper, 5 per cent. tin, 22 per cent. lead, and 3 per cent. zinc. The time of charging and pouring averaged 45 minutes per heat, due to foundry conditions; had it been possible to reduce this time, the capacity and economy of the new furnace would have been increased further. The capacity per hour was increased 2.6 times, and the energy consumption was reduced by 170 kWh per ton, when taking into consideration the heat-up over Sunday.

A Diesel-electric Ship.—Built by the Bethlehem Shipbuilding Corporation, the Diesel-electric tank vessel, *Hawaiian Standard*, has been delivered to her owners, the Standard Oil Co., of California. She carries about 1,875 tons of oil, is fitted with two Pacific Werkspoor engines, which give a total output of approximately 1 000 i.h.p., and is a sister ship to the *Alaska Standard*, which was completed some time ago. Her length is 210 ft. between perpendiculars.—*Motor Ship*.

Submarine Cables and Wireless Telegraphy.—On May 26th Sir Charles Bright, F.R.S.E., gave an address on "Telegraphic Communication" before the Grotius Society, in which he dealt with the lessons of the war, and advocated the provision of communication between the parts of the Empire by a greater variety of routes, both by cable and by wireless telegraphy. He maintained that the latter should not be relied on solely in war time, owing to its lack of secrecy and liability to interruption by atmospheric conditions. Inter-Imperial cables should not land on foreign soil; they should be controlled by the State, and operated in the national interest at low rates. For these reasons a Board of Telegraphic Control should be set up. Sir Charles laid stress on the incalculable advantages conferred upon the Empire just before and during the war by our submarine cable system, whilst the enemy had to make up for the lack of such facilities by developing wireless telegraphy.

I.E.E. (Western Centre) Summer Meeting.—As was briefly recorded last week, about 100 members, many being accompanied by their lady friends, recently inspected Messrs. R. A. Lister & Co.'s works at Dursley, as part of the proceedings of the summer meeting of the Western Centre of the I.E.E. The party was welcomed by Mr. F. H. Lister, secretary and acting managing director, Mr. R. B. Lister and Mr. A. E. Mellerup, directors and joint works managers, and the other senior members of the staff, including Mr. J. T. Rymer, who is in charge of the electrical department. Particular interest was shown in the electric lighting plant department and also the power station that has recently been opened for supplying the works. The sale of lighting sets has increased so rapidly that this part of the works is now being doubled in size to cope with the demand, a large number of orders for lighting plant going overseas to all parts of the world. It was quite a surprise to find in this quiet and picturesque little Gloucestershire town so extensive a works with such up-to-date plant and production methods; for instance, a multiple drilling machine bores all the holes in the side of an engine crankcase simultaneously in 15 minutes. The fine and accurate work of the sheep-shear department also proved of considerable interest. In the Colonies and South America these machines have almost entirely supplanted the antiquated methods of hand shearing, and it is an interesting fact that Lister machines are responsible for the shearing of one third of the world's sheep. The sheep-shear department is working continuously night and day.

Space does not permit us to do more than mention the wide range of Lister dairy appliances. A diversion was caused at tea-time by a raffle for one of the Lister ornamental tubs which formed part of the decoration of the room. The proceeds were devoted to the Institution's Benevolent Fund, the winner of the raffle being Mrs. Shute.



The I.E.E. Western Centre Summer Meeting.

Institution Notes.

The Institute of Physics.—At the annual general meeting held on May 25th, Sir William Bragg was elected President in the place of Sir Charles Parsons, whose term of office expires on September 30th next. Major C. E. S. Phillips was elected to succeed Sir Robert Hadfield as treasurer. The remaining offices were filled as follows:—Past-Presidents, Sir R. T. Glazebrook, Sir J. J. Thomson, Sir Charles Parsons; Vice-Presidents, Professor C. L. Fortescue, Dr. E. H. Rayner, Sir Napier Shaw, Mr. R. S. Whipple; hon. secretary, Professor A. W. Porter. The annual report gives the total membership as 515, which includes 293 Fellows and 135 Associates. Much of the report is devoted to the *Journal of Scientific Instruments*, the second volume of which is now appearing. Editorial control has been brought into closer touch with the scientific instrument industry. A local committee has been constituted in Australia and Professor A. D. Ross, of the University of Western Australia, has been appointed local honorary secretary of the Institute in that Dominion.

Association of Mining Electrical Engineers.—The South Wales branch of the Association of Mining Electrical Engineers has arranged an interesting and instructive programme for its annual meeting in Cardiff, June 9th-13th. The programme includes a civic reception by the Rt. Hon. the Lord Mayor of Cardiff, and several visits to works and places of general interest in and around Cardiff. A joint meeting has been arranged with the Western Centre of the Institution of Electrical Engineers, at which Major E. I. David, M.I.E.E., will read his paper on "Electricity in Mines." Mr. Theodore Stretton, M.I.E.E., is the President-elect of the Association, and he will be formally elected at the meeting.

Institution of Electrical Engineers.—NOMINATIONS FOR COUNCIL.—The following gentlemen have been nominated by the Council to fill the vacancies that will occur on the retirement of those who have completed their term of office:—President: Mr. R. A. Chattock; vice-presidents: Lieut.-Col. K. Edgcumbe, R.E. (T.A.), and Prof. W. M. Thornton, O.B.E., D.Sc.; hon. treasurer: Mr. P. D. Tuckett; ordinary members of Council: Prof. C. L. Fortescue, O.B.E., M.A., Messrs. H. Marryat, R. W. Paul, S. J. Watson, R. Grierson, J. W. T. Walsh, M.A., M.Sc., E. Leete, and Major E. O. Henrici, R.E.

Our Personal Column.

The Editors invite electrical men, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Mr. J. W. SPARK, borough electrical engineer at West Hartlepool, recently accepted a similar position with the Bath Corporation. At the meeting of the West Hartlepool Council on May 26th the Electricity Committee brought forward a recommendation that Mr. Spark's salary should be in accordance with the national minimum scale for chief electrical engineers. This would amount to £1,015. The Committee also recommended that Mr. Spark should be asked to withdraw his resignation. On the proposition of Ald. C. Macfarlane, chairman of the Committee, it was agreed that the recommendation should be discussed in private, and a resolution was carried to the effect that the national minimum scale for chief electrical engineers should be adopted; that the Bath Corporation should be asked to release Mr. J. W. Spark from the acceptance of his position there; and that failing the Bath Corporation releasing Mr. Spark, a borough electrical engineer should be advertised for on the national terms.

Captain C. JACKSON, general manager of the Keighley tramways, has been appointed manager of the Oldham tramways in succession to Mr. W. Chamberlain, who, as already announced, has left for Leeds.

Mr. A. H. BESCHE, for many years sales director of Messrs. Kerr, Stuart & Co., Ltd., has been appointed general sales manager of the engineering department of Messrs. J. & F. Howard, Ltd., Bedford.

A *Reuter* dispatch from Montreal states that Mr. CHARLES G. GREENSHIELDS has resigned the presidency of the board of directors of the Marconi Wireless Telegraph Co. of Canada, and Mr. G. M. Bosworth has resigned his directorate. Dr. Milton L. Hersey becomes the new president, and Mr. H. M. Short general manager and managing director.

The Blackburn Tramways Committee has discussed a proposal to increase the salary of the tramway manager (Mr. J. H. COWELL).

The Shoreditch Borough Council has extended the service of Mr. C. NEWTON RUSSELL, the borough electrical engineer, for a further period of six months.

Birthday Honours.—The King's Birthday Honours List, published on Tuesday morning, His Majesty's sixtieth birthday, is of special interest to electrical men. We tender our hearty congratulations to Mr. HUGO HIRST, chairman of the General Electric Company, Limited, upon whom a baronetcy has been conferred; and to Mr. HERBERT EDWIN BLAIN, C.B.E., formerly so closely connected with the tramway world, later assistant managing director of the London Underground Railways, and subsequently principal agent of the Conservative

Elliott & Fry] [*London.*

Sir Hugo Hirst, Bart.

and Unionist Party, upon being made a Knight; also to Sir J. F. C. SNELL, chairman of the Electricity Commission, upon receiving the appointment of G.B.E. (Civil Division). We further congratulate the following:—Lieut.-Col. and Brevet-Col. ERNEST ROBINSON, O.B.E., T.D., Tyne Electrical Engineers, Territorial Army, upon being made a C.B.E. (Military Division); Mr. T. M. AINSCOUGH, O.B.E., H.M. Trade Commissioner in India and Ceylon, appointed a C.B.E. (Civil Division); Mr. Z. H. KINGDON, Superintending Electrical Engineer, Grade I, Devonport Dockyard, who receives the honour of O.B.E. (Civil Division); Mr. JANAKI NATH MUKERJI, Chief Electrician, Posts and Telegraphs Department, who in the list of Indian Awards is made an O.B.E. (Civil Division); and Mr. R. MCILROY, Superintending Engineer, London Engineering District, G.P.O., who is made a Companion of the Imperial Service Order.

Obituary.—SIR W. F. BARRETT.—We regret to record that Sir William Fletcher Barrett, F.R.S., F.R.S.E., M.I.E.E., the well-known physicist and chief founder of the Society for Psychical Research, passed away suddenly on May 26th at his residence, 31, Devonshire Place, London, W., aged 81 years. Professor Barrett was born in Jamaica and educated at the Old Trafford Grammar School, Manchester. When nineteen years of age he was appointed assistant to Professor Tyndall, who was Professor of Natural Philosophy at the Royal Institution. Other appointments which followed were: Lecturer on Physics at the Royal School of Naval Architecture, and for many years (from 1873 until 1910), Professor of Physics at the Royal College of Science in Dublin. Psychical research was one of the outstanding subjects to which he devoted study; his celebrated address on "Thought Transference" was delivered before the British Association in 1876 and practically the last interest on the day of his death was psychical research, a discussion on which he attended. He contributed largely to the discoveries of physical science, conducted much research, and wrote many papers and books thereon, some relating to the electrical and magnetic properties of alloys of iron, especially "Stalloy," so largely used in the construction of electrical machinery; he was also interested in X-ray research and in the application of X-rays in surgery.

MR. E. J. JENNINGS.—A correspondent states that the death of Mr. Edward J. Jennings, A.M.I.E.E., an electric power engineer of Newcastle-on-Tyne, is reported from St. Malo, where he was spending a holiday. He left Newcastle on May 25th, and word of his death in an hotel in the French town named reached Newcastle on the following day.

MR. J. HUNTER GRAY.—We learn with regret of the death, which occurred on Monday last in a London nursing home, of Mr. James Hunter Gray, K.C., M.I.E.E., at the age of 57 years. In Mr. Hunter Gray were combined very high legal and scientific qualifications, which enabled him to render invaluable service to electrical and other clients in important patent and other law suits. He was constantly present in the Courts in connection with historic electric lamp patent litigation some years ago, his ability in handling such matters being most exceptional, and demonstrating the value to the barrister of having qualified as an electrical engineer and having taken a scientific degree. He was an Associate of the Institution of Electrical Engineers in 1899, and became a full member in 1919. *The Times*, in reviewing his career, says:—"There were few members of the Bar who had a greater knowledge of patent law and a greater facility in arguing lucidly the complicated points which arise in patent actions. . . . Hunter Gray knew his work with a knowledge which was not acquired from his brief. He was himself a man of science, with the rare faculty of simplifying and condensing the points at issue in cases which seemed to disclose 'wilds interminably spread.' In trade mark actions he was equally efficient, and his acquaintance—even without consulting books—with the relevant decisions was unsurpassed. His absence as an advocate and a lawyer, especially from the Court of Appeal, will be felt, for he knew his subject and he was of the greatest assistance to the Bench."

MR. R. H. BEST.—We regret to hear, at the moment of going to press, of the death of Mr. Robert Hall Best, which occurred on Monday at his residence at Handsworth, in his 82nd year. At the age of 14 years Mr. Best entered the business of his father, Mr. Robert Best, a manufacturer of brass goods. The firm eventually became a company, and it has been known to the electrical trade for many years as Best & Lloyd, Ltd., gas and electric light fittings manufacturers, Cambray Works, Handsworth, Birmingham. Though the deceased gentleman did not take a prominent part in public affairs, he devoted himself enthusiastically to the well-being of the British brass industry, and he was largely responsible for the investigation of conditions in that highly-developed industry in Germany some twenty years ago, an inquiry which brought to light facts which were not previously recognised here as they should have been, regarding the advanced state of German factories and organisation. Mr. Best also took a very keen interest in secondary education and trade schools, again a subject of which he made a study in Germany. He was for many years president of the Brassfounders' Employers' Association. He leaves one son—Mr. Robert Dudley Best. His other son was shot down while flying over the enemy lines in 1917. The founder of the business—Mr. Robert Best—died in 1863. Mr. R. H. Best, who has just passed away, was very early connected

Whitlock & Sons, Ltd.] [*Birmingham.*

The Late Mr. R. H. Best.

with the concern; he was a part proprietor until 1878; then sole proprietor; and since 1879 chairman of the directors. Formerly he was a prominent citizen of Birmingham, but in recent years, owing to advancing age, he had not been in the public eye.

Wills.—The late Mr. J. E. HOUGH, of the Edison Bell Consolidated Phonograph Co., left £37,421.

The late COL. SIR A. M. J. O'RELVIE, late joint secretary to the G.P.O., left £13,846 gross and £10,993 net personalty.

New Companies Registered.

G. S. Hawker, Ltd. (206,181).—Private company. Registered May 23rd. Capital, £1,000 in £1 shares. Objects: To adopt an agreement with G. S. Hawker and to carry on the business of electrical and general engineers, founders, smiths, manufacturers, contractors, patentees and dealers in electrical machines, equipment, and apparatus or parts thereof, haulage and general contractors, &c. The directors are:—C. R. Lilly, Netherdale, Grand Avenue, Worthing, dried fruit merchant; H. W. Sadler, Woodgate, Wimblehurst Road, Horsham, dried fruit merchant; G. S. Hawker, 2, Purley Downs Road, South Croydon, electrical engineer. Qualification, £1. Remuneration as fixed by the company. Secretary: H. A. Douglas, 130, Braidwood Road, Catford, S.E.6. Solicitors: A. Charles Knight & Co., 1, Queen Victoria Street, E.C.4. Registered office: 1, Queen Victoria Street, E.C.4.

Flair Construction Co., Ltd. (206,253).—Private company. Registered May 27th. Capital, £100 in £1 shares. Objects: To carry on the business connected with wireless telegraphy and telephony, particularly with reference to the utilisation of the magnetic field for all purposes of reproduction such as loud speakers and telephones, and also the application of ideas and inventions for the conveyance of sound in telegraphs, telephones and gramophones, manufacturers of and dealers in all articles and apparatus connected with wireless telegraphy and telephony and gramophones, &c. The subscribers (each with one share) are:—E. S. Brown, 51, Milton Street, E.C.2, woollen buyer; E. P. G. Bridge, 1, Tanfield Court, Temple, E.C.4, solicitor. The first directors are not named. Secretary: E. S. Brown. Solicitors: W. R. Wood, 33, Chancery Lane, W.C.2. Registered office: 51, Milton Street, E.C.2.

North London Valve Co., Ltd. (206,259).—Private company. Registered May 27th. Capital, £500 in £1 shares. Objects: To carry on the business of ironfounders, mechanical and electrical engineers, manufacturers and repairers of valves and other parts, plant and appliances for wireless and general electric business, &c. The directors are:—F. A. Goulding, 22½, Cazenove Road, Stoke Newington, N.16; S. F. Game, address not stated; R. H. Lewis, 22½, Cazenove Road, Stoke Newington, N.16. Qualification, 5 shares. Solicitors: Howard & Shelton, Lincoln's House, Fore Street, E.C.2. Registered office: 22½, Cazenove Road, Stoke Newington, N.16.

Filters, Ltd. (206,299).—Private company. Registered May 28th. Capital, £2,000 in £1 shares. Objects: To carry on the business of designers, and manufacturers of, agents for, and dealers in air filters for turbo-alternators and colliery air compressors, &c. The permanent directors are:—G. Machin, 65, Townend Road, Ecclesfield, Sheffield; C. C. McKinley, 811, Abbeydale Road, Sheffield. Qualification, £100 shares. Secretary: G. Machin.

Official Returns of Electrical Companies.

Godfrey Salmon, Ltd.—W. A. J. Osborne, of 119, Finsbury Pavement, E.C.2, was appointed receiver on May 15th, 1925, under powers contained in charge dated May 27th, 1924.

Melbourne Electric Supply Co., Ltd.—Supplemental trust deed dated April 27th, 1925, to secure moneys payable under various trust deeds securing the debenture bonds and stocks of the company, charged on purchase price and consideration money and interest payable in default of prompt payment under an agreement dated June 18th, 1924, with the Hon. Sir Arthur Robinson, K.C.M.G., on behalf of H.M. Victorian State Government. Trustees: Debenture Corporation, Ltd., Electric and General Investment Co., Ltd., Anglo-American Debenture Corporation, Ltd., and the Melbourne Trust, Ltd.

Korland Manufacturing Co., Ltd.—C. L. H. Martin, of 27, Chancery Lane, W.C.2, ceased to act as receiver or manager on April 6th, 1925.

City Notes.

Callender's Cable and Construction Co., Ltd.

The annual meeting was held on May 28th, Sir Fortescue Flannery, Bart., presiding. In moving the adoption of the report (*vide* our last issue, p. 867), the chairman said that the figures clearly showed the great enlargement which had taken place in the business during the past year. The growing extent of their operations made heavy calls upon them in respect of capital, and although they had large sums in reserve and in their carry forward, these were not sufficient to meet all their needs or to make them feel confident regarding the still larger demands which they would have to face in the future. It was a pleasure in a time of general difficulty in manufacturing and of great unemployment to find that all their workshops and those of the Anchor Co. had been fully employed throughout the year. The development in the use of electricity for all purposes showed no signs of diminution, and he felt sure that it would continue, especially if it were helped by legislation. It was to be hoped that the contemplated legislation to facilitate the extension of electrical operations would be carried out by Parliament under careful expert advice, as otherwise more harm than good might result. Increasing demands were being made upon cable manufacturers for mains to be worked at higher voltages. They had been ready very early to meet that demand, and they were now the leading specialists in that branch of cable manufacturing. The chairman then referred to the new departure with regard to the business in America, which was mentioned in the report. He said that e.h.p. cables had been in successful use in the United States, but to a very small extent, and it was felt that the experience which they had would be of great use and advantage in that country, where cables to work satisfactorily at 33,000 V were now being very urgently called for. The Okonite Co., was anxious to develop on lines which had proved successful with Callender's, and after negotiations extending over several months an agreement was arrived at by which the Okonite-Callender Cable Co. was formed. A large new factory would be erected in the United States specially designed for the purpose and also for making other cables on methods which had been adopted in this country. They felt no doubt that after many years of waiting the moment had arrived for that advance into America, and they had every reason to believe that it would prove successful and highly profitable to all concerned. To carry out the arrangement, additional capital was necessary, and the board had decided to increase the capital to 1½ millions by the creation of 200,000 additional £1 ordinary shares. It was only proposed to issue 100,000 of the new shares at once, leaving the remainder for a future occasion. They proposed to allot the new shares to the existing shareholders in the proportion of one new share to every five ordinary shares held on June 4th at the price of £2 10s. for each new share. The new shares would not participate in the interim dividend which it was customary to pay in November, but after that date they would rank *pari passu* with the existing ordinary shares.—Sir T. O. Callender, in seconding the motion, said that the business generally had increased rapidly during the past year, and they were looking forward to a moderately good current year. With regard to their home trade, the red drums, which were the trade mark of the company's enterprise, were to be found in almost every city and town throughout England, and it was the same in Scotland and Ireland. They had found their Continental business less satisfactory; in fact, the conditions prevailing throughout Europe had rendered it almost impossible for them to continue the large trade which they formerly did with Continental customers. The long hours worked by the men, the low rate of wages paid and the almost entire freedom from any restrictions of methods of work, and the rates of exchange which were universally unfavourable to Great Britain, had all rendered it out of the question at present to supply on the Continent with any margin of profit. They were therefore devoting their attention elsewhere, leaving the Continent to a future date when more happy conditions should prevail. With regard to their oversea trade, their greatest activities were Eastward. They had always done a considerable amount of business in Bombay, and were continuing to do so. They were now carrying out work at Agra. Other cities in India in which they were working included Delhi, Rangoon, &c., and the Government of India had placed in their hands the contract for distribution in the whole of the Aden Peninsula. In the Malay States they were represented by the Borneo Co. Passing to China, it was a matter of great surprise to them that in spite of the anarchy and revolution in that empire they were doing an increasing business there. They had been fortunate in Australia, having received some large orders in Sydney. A lot of work had been done in New Zealand, and they had pushed their activities into the islands of the Pacific. It might truly be said that in every port from Manila following the sun westwards to Mombasa and Zanzibar, right round to Newfoundland, across Canada to British Columbia, they would find their work and evidences of their existence, in all of which places they had done an increasing business last year. In conjunction with several firms of high repute in the City, they were forming a company for the purpose of carrying out for the Sudan Government in Khartoum a complete system and rearrangement of all the public services of the city. Their part of it was in connection with electric cables and tramways, and they were looking in the future to further developments in the Sudan. They had been working in Egypt for a good many years, and in spite of the political upheaval and other troubles they had done a reasonable and an increasing business, and they hoped for good results to follow if the conditions remained even as indifferent as they were at the present time. As to America, he believed it would not be long before their drums would be as prominent in the United States and in Canada as they were in this country.—The report was adopted, and subsequently an extraordinary meeting was held at which the necessary resolutions for increasing the capital of the company were agreed to.

W. T. Henley's Telegraph Works Co., Ltd.

The 46th ordinary general meeting was held on May 29th at the Great Eastern Hotel, under the presidency of Sir George Sutton, Bart., M.I.E.E. In moving the adoption of the report the chairman reminded the shareholders that the present accounts covered a period of 15 months as against the normal 12. The profit and loss account showed a larger net balance to credit of £300,137 compared with the previous year, but with three months added to bring it into line, the amount would be £250,000. The carry forward was £480,000, against £379,000 brought in. The increase in the value of land &c., amounting to £115,616, was, so far as land was concerned, due to the purchase of that part of Rosherville Gardens which was situated behind their Gravesend works, which had been acquired for the extension of their operations there. There was an expenditure of £25,000 in connection with their new leasehold offices and warehouses at Holborn Viaduct. They had taken a new valuation of their plant and machinery by their own people, who were skilled advisers, and taken at a low estimate, it showed their property to be worth £60,000 in excess of the balance sheet figures. The general business had progressed and many large contracts for the construction and laying of cables had been carried out. They had done considerable work for the Post Office for trunk and distribution cables. They were just completing a large contract for cables for the electrification of part of the Southern Railway, and they had on their books a large order of a similar kind for e.h.p. cables for the electrification of suburban railways in South Africa. They had been engaged in the construction and laying of parts of the networks of e.h.p. cables for the

County of London Electric Supply Company. They had now had large experience in the manufacture of cables for carrying pressures of 30,000 volts and upwards. The were developing a new type of cable to work up to 60,000 volts. Last year the works were visited by engineers from the United States, and they subsequently received orders for the construction and laying of e.h.p. cable for Chicago and Milwaukee. At their research department at Gravesend they were able to deal with cable testing up to nearly 500,000 volts. The result of the 15 months' trading he confidently supposed was satisfactory to shareholders, and they must be interested to learn how the results had been obtained. Large business undertakings must not have so narrow an outlook as to put foremost in their endeavours the desire to make large profits to pay large dividends. It was not less desirable to extend an undertaking so that more employment could be given. The company had been raised to its present position by trying to give effect to such opinions. Their good results had been obtained in the first place by a wise conservation of their liquid resources, by reserves against all possible contingencies which might arise, and by limiting the dividends in favour of a substantial amount carried forward. Those measures had enabled the adoption of enterprise and extension to secure a growing turnover year by year. They showed a larger profit than hitherto, and yet the actual percentage of profit made was, he thought, the lowest in the company's history. But the sales were the highest in the company's history. So they arrived at the position that by means of cash resources, by lower prices for their products, by a smaller percentage of profits, by larger turnover, and by increased employment they had a record result. Employment had increased by from 15 to 20 per cent. over 1923, and was three or four times greater than in 1914. The improvement in the profit was due only to the increase in sales. Nothing was derived from an increased production from labour, or by lower wages. The production of labour per head in their factories had not improved during the past three or four years, but it was satisfactory. The production improved considerably some five or six years ago and had not fallen since. Neither had the balance of profit increased by reason of lower wages; actually the wages paid for the processes of cable-making showed all round increases over 1923. Their rates and taxes were equal to 20 per cent. of the wages bill of their factories. He had told them how the profits had been made, and it was important to know whence they had been made. The home sales followed all former precedents by being their chief reliance for keeping the works fairly employed. But the overseas trade had improved also. He thought he ought to consider it satisfactory, and he dared say that he would if he did not very critically analyse it. The analysis showed that the British Empire overseas trade was satisfactory, and the foreign trade was unsatisfactory. Empire trade was over 30 per cent. greater in 1924 than the average of the previous five years, while foreign trade was 60 per cent. less. Obviously such a result required serious consideration by the management. They knew, of course, of some of the circumstances which were operating to their disadvantage, but their records showed that the principal reason for the falling off of orders was not solely because foreign customers were supplying their needs by factories of their own. That was one reason, but a special cause of the reduction was the severe price competition by other countries. They could, and did secure some foreign orders by selling below cost price; they had financial strength, and within certain limits could do that, but they declined to accept the risks with regard to credits and conditions of supply which some of their foreign competitors did. The disappointing feature of the report was, of course the accounts of the Tyre Company, but even that company, notwithstanding the difficulties in the way of its progress, was better than a year ago. It seemed that it had turned the corner. He was hopeful, but could make no promise regarding the tyre company, for the difficulties with regard to competition were very great, and they were working on an artificial basis of the trade in raw rubber. To sum up, the condition of the business was healthy, and the promise of the future satisfactory. They were associated with two non-profit earning associations which had been formed at the expense of manufacturers and suppliers for the education of the public in the advantages of the telephone and other electrical appliances in the homes of the people of this country. To understand those advantages was to desire them, and the Telephone Development Association and the Electrical Development Association had done, and were doing, good work to make them known. The field was large, the labourers were many, and those Associations were helping them to find work for their hands to do. Mr. Martin Roberts seconded the motion, which was carried unanimously. Following the transaction of the formal business, a bonus of £500 was voted to each of the directors by way of extra remuneration in appreciation of their services during the past 15 months.

Anglo-Argentine Tramways Co., Ltd.

The report for the past year shows gross receipts of £4,640,364, and working expenses (including £150,000 for renewals), of £3,580,564, leaving a balance of £1,059,800. Interest, &c., makes this up to £1 081,423, and the deduction of debenture interest, sinking fund, &c., leaves £414,408, to which is added £13,638 brought forward, making £428,046. It is proposed to allocate this as follows:—Dividends on preference shares, £359,000; to contingencies fund, £45,000; carried forward, £24,046. The number of passengers carried rose from 518,733,718 to 557,849,937; and the working expenses amounted to 70.50 per cent. of the receipts, as against 71.56 per cent. in 1923. The authorities have not yet acceded to the company's request for a modification of the position created by the arbitrary reduction of the fare to 10 cents, from April, 1923, combined with a continuance of the heavy obligations placed upon the company. As a result the company is again unable to pay a dividend on its ordinary capital. The company had not even received the compensation to which it has been held entitled under the National Pension Law. Traffic congestion in the streets has been aggravated by an increase in the number of omnibuses, some of which act in competition with the company, while others act as feeders. The construction of a second subway is a matter of urgent importance, but the provision of the large capital expenditure involved depends upon the granting of fair and just tariff conditions. The delays in dealing with the traffic situation are unfortunate, but the company has spared no effort in endeavouring to evolve a plan which will relieve the congestion and enable it to continue in an extended form the efficient services which it has rendered for the past 40 years. The report mentions the death of two directors, Mr. C. S. Rose and Mr. S. H. Pearson, and the resignation of Sir Philip Cunliffe-Lister. Meeting, June 9th.

Siemens Bros. and Co., Ltd.

The annual meeting was held on May 26th, Mr. G. Mure Ritchie presiding. In moving the adoption of the report (ELEC. REV., May 22nd, p. 829), the chairman, after dealing with the figures in the balance-sheet, said that, regarding the recent issue of preference shares, he wished to explain that that issue was made primarily not to bring in additional funds; they had a special opportunity of effecting certain trade arrangements which would materially assist the company in technical and other directions, and the issue of preference shares was found to be the most convenient method of seizing that opportunity. The effect on the business had been very satisfactory, and was likely to continue to be so. The shareholders should realise that in this particular transaction the company had acquired something valuable which could not have been supplied either by the shareholders or by underwriters. Having referred to the fact that at the end of last year the company's employés numbered 6,584, as against 3,300 in January, 1923, the chairman said the extensions to which he had referred last year for telephone, power, and lighting cables had been in full use in 1924. At previous meetings he had referred to the great importance which the board attached to the probable development of automatic telephony in this country and the world over. He was glad to say that the large expansion in business which they anticipated had now begun. The British Post Office, having decided on very large developments, was already making great demands on their manufacturing capacity, and Colonial and foreign administrations were also adopting very extensive programmes of development which would probably make great calls on that class of manufacture for some years. The board had decided on a scheme of extension to meet those probable demands, and, owing to the fact that some years ago they had acquired additional land at Woolwich, they had been able to make the necessary expansion without the demolition of anything important and with the minimum of disturbance. The electrical industries were amongst the few which to-day were well occupied, and the company was sharing in that prosperity. The total amount of orders received in 1924 was £3,698 695, against £2,947,785 for 1923, and on the whole prices had been somewhat better. The extension of the Imperial submarine cable to the West Indies and British Guiana had been successfully completed, and the cable, consisting of about 1,700 nautical miles, had been put into service, as was also the second section of the cable connecting Alaska to the rest of Nova Scotia, the latter contract comprising about 2,000 nautical miles in all. An important addition was being made to the world's cable communications by the new Italian cables, which were establishing communication between Southern Europe and the North and South American Continents. They had been successful in securing orders for two important sections of that large undertaking. Their contract was for 3,300 miles of cable to be laid from Cape Verde Island to Rio de Janeiro. A large portion of the contract was completed during 1924, and they had just received a message from their cable ship *Faraday* that she had successfully completed the laying of the whole cable. Last year he had mentioned the new type of telephone cable for connecting the Continent with England. That cable, comprising 84 nautical miles, was duly completed and laid last August, and had more than fulfilled expectations. In underground power cables they had made a new departure by the manufacture of a 12,000-V cable which was to be laid beneath the sea in order to connect an island with the mainland. The cable, which was of unusually large dimensions, was 9,000 yards long and had been made in a single length. It weighed about 280 tons, and had just been dispatched to its destination in the East Indies. The latest extensions to their cable factory had been specially designed to deal with a growing demand for cables made in sections of great length, and they were now able to manufacture lead-covered cables in unprecedented lengths. A large expansion had taken place in automatic telephone exchanges, and during the year they had had a continually increasing volume of contracts for that class of work. They were also carrying out preparations for the conversion of the London telephone system, in co-operation with the Engineering Department of the Post Office. The first exchange with the conversion of which they had been entrusted was "Western," with an initial capacity of about 7,000

lines. Their radio-telephone apparatus business had also increased in volume, and he had to record in particular a very important improvement which they put on the market during 1924 in a wireless direction-finder for use on board ship, which gave an accuracy far in excess of anything which had yet been achieved in that line. Referring to the future, he said that the prospects seemed gratifying. So far they had received very substantial orders, among which was one from the Pacific Cable Board for a loaded telegraph cable joining Suva in Fiji with Fanning Island; that was a high-speed cable of the newest type. They had also obtained a contract from the Egyptian Government for the first automatic telephone exchange in that country. The expansions to which he had referred were likely to continue for some time. The development in their cable business reflected the greater activity which was going on in the electrical world generally, and in the case of telephone development they had to deal with what was clearly a genuinely expanding demand the world over, and very particularly in this country. The greater activity in their larger departments was also shared in the smaller ones, such as ebonite, broadcasting, batteries and woodwork, and in most cases their manufacturing capacity was being taxed to the utmost. In concluding, he referred with regret to the recent resignation, through ill-health, of Mr. Chauvin, the managing director, and announced that the board had appointed Mr. Francis Hird, who had been Mr. Chauvin's principal assistant for many years, to succeed him.—Sir Walter Lawrence seconded the motion, which was unanimously agreed to.

United River Plate Telephone Co., Ltd.

The gross revenue for 1924 was £1,810,310 and the profit £344,321. The deduction of debenture interest and preference and interim ordinary dividends leaves a balance of £223,621, to which is added £42,665, making £266,286. It is proposed to pay a final dividend of 5 per cent. on the ordinary shares, making 8 per cent., free of tax, for the year; to transfer £35,000 to the exchange suspense account; and to carry forward £69,286. The report states that the company continued to make satisfactory progress, and a record number of new connections were made; there is still, however, a comparatively large waiting list and very considerable extensions have recently been ordered. To provide the necessary funds to meet this expenditure it is proposed to increase the capital to £5,000,000, by the creation of 200,000 shares of £5 each, although it is not the directors' intention to make an immediate issue. Meeting, June 9th.

Eastern Telegraph Co., Ltd.

The revenue for the past year amounted to £3,028,199, and the balance on working to £1,298,039. After providing for taxation, preference dividends, loan and debenture interest, &c., there remains a surplus of £939,895, to which is added £521,423 brought forward, making £1,461,318. The directors have placed £450,000 to the general reserve fund and have applied a similar amount from that fund to reduce the expenditure on new cables, &c. Four dividends of 2½ per cent., free of tax, each have been paid on the ordinary shares. A balance of £511,318 is carried forward. With a view to effecting a saving in working expenses, &c., agreements have been concluded with the subsidiary companies for the working of these as from January 1st, 1925. The company will receive all revenue and pay working expenses, paying in consideration thereof an annual sum in the nature of rental. Meeting, June 9th.

British Thomson-Houston Co., Ltd.

The annual meeting was held on May 28th, Mr. H. C. Levis presiding. In moving the adoption of the report (which was reviewed in our issue of May 22nd, p. 829), the chairman said he thought it would be considered satisfactory, particularly having in mind the general trade conditions which existed during the year under review. They had been able to make an allowance for depreciation of £166,953, as against £135,440 for the previous year, to recommend a dividend of 6 per cent., less tax, on the ordinary shares, and to increase the reserves. The value of orders for the year exceeded by a substantial amount those secured in 1923. The expenditure on buildings and equipment during the year amounted to £343,000, a considerable portion of which was in connection with extensions to their works at Willesden, and they had further commitments necessary to take care of the development of their manufacturing facilities. In the balance-sheet for 1921 they had created a reserve for contingencies of £100,000, which was continued in 1922 and 1923. It was created when there were many uncertainties relating to fluctuating inventories, &c., but now, in the opinion of the directors, it was no longer necessary to continue it. £30,000 had been used to write off the entire balance of the cost of converting the preference shares, and £70,000 had been transferred to the general reserve account. An additional £50,000 had been transferred to the general reserve, which now stood at £220,000. The profit for the year, after deducting all expenses and charges other than interest, was £514,980; and adding the amount brought forward from the previous year of £210,863 gave a total of £725,843 to be dealt with. From that was deducted £122,595 for interest, and £216,953 for reserves and depreciations, including the sum of £24,030 written off the cost of converting the preference shares from "tax free" to "subject to tax," leaving £386,295 to be carried to the balance-sheet. Competition continued to be keen both at home and abroad, and in some directions there was a tendency for the volume of home orders to fall off, but in view of the electrical developments which were bound to take place in the comparatively near future, it seemed to him that that downward tendency could only be regarded as temporary. A large percentage of their orders came from the Colonies and many other countries, so that the reputation of the company's products was world-wide. Those products included everything electrical, from the smallest lamp and motor to the largest turbo-generator, as well as a complete line of fittings, cooking and other domestic appliances, all types of radio apparatus and valves, and magnetos. During the year the company, in association with other companies and individuals, became largely interested in a new company, known as Austin Lighting Co., Ltd., which, it was expected, would take a very active place in rural electrical development.—Lord Carmichael seconded the motion, and it was carried.

Shropshire, Worcestershire, and Staffordshire Electric Power Co.

Mr. E. Garcke presided at the annual meeting of the company on May 27th, and in presenting the report and accounts said that during the year good progress had been made and a number of changes had been made in the capital position and legislative status of the company. The issue of £650,000 of 5½ per cent. debenture stock, for the redemption of the 7½ per cent. convertible stock and the repayment of the Government loan, had been successfully carried through, thus improving the financial position. In 1924 £100,000 had been spent on capital account, of which £70,000 was in respect of mains. The Smethwick, Dudley, Redditch, and Kidderminster stations were inter-connected, and they would all be connected with the Stourport undertaking by the end of the current year. Additional lines were being installed between Redditch and Evesham, and these would be continued to Stourport, *via* Upton-on-Severn. After referring to the Joint Advisory Committee for the South-West Midlands District, consisting of representatives of the company and the City of Birmingham, the chairman said that the company had made application for a Special Order to enable it to supply electricity for all purposes in an area to the south and south-east of the statutory area; this was known as the "Avon Valley" order. A controlling interest in the Tewkesbury Electric Light Co. had been acquired. The whole of the company's system was being linked up with the large Stourport station, and eventually would be connected to the Nechells station of the City of Birmingham.

Cawnpore Electric Supply Corporation, Ltd.

The annual meeting of the company was held on May 25th, when Mr. J. G. B. Stone, who presided, in presenting the report and accounts (ELEC. REV., May 22nd, p. 829), said that the profits, after providing for debenture interest, had increased by 25 per cent. During the year the capital had been raised to £320,000 by the issue of ordinary (£1,493) and preference (£78,507) shares. The total capital in the business was £580,580. The sales of energy had increased by 40 per cent., and the receipts on this account by 32½ per cent.; the maximum demand had risen by 54 per cent. to 5,299 kW. Owing to delays the increase of 200 per cent. in the capacity of the Riverside station was only made available towards the end of the year. The company now had a large margin of earning capacity awaiting development, the equipment at the Riverside station representing 18,000 kW. He had every confidence that this would soon be taken up, and he hoped for an early improvement in the cotton industry, which was one of their largest sources of revenue.

Electric Construction Co., Ltd.

The directors report that the net profit for the year ended March 31st, 1925, after providing for debenture interest and £10,000 for depreciation, was £43,031, plus £21,717 brought forward, making £64,748. The preference dividend (7 per cent.) is paid, and a final dividend at the rate of 9 per cent. per annum is recommended, making 7½ per cent. for the year, on the ordinary shares, which are also to receive a bonus of 2½ per cent. (all under deduction of income tax). There is to be transferred to staff and workpeople's superannuation fund, £5,000, and to general reserve fund (which will then amount to £165,000), £3,942 leaving to be carried forward, £21,411. The report says:—"Keen competition continued to prevail in the electrical engineering industry during the past financial year, and many orders had to be accepted with a very small margin of profit. The demand for the company's manufactures was well maintained, however, and the net profit shows a small increase." Meeting, June 9th.

Barcelona Traction, Light and Power Co., Ltd.

Details of the financial results for 1924 of the undertakings comprised in this company were given in our issue of May 18th (p. 788). The report of the directors states that there was considerable depression throughout the year in several of the important trades in Cataluña, particularly in the textile business, but in spite of this there was a substantial expansion in the sale of energy. This was mainly attributable to the increase in the number of small power users and the great building activity. The spillway gates and low-level penstock connection at the Camarasa power plant have already fully justified their cost, having made available some 23 million kWh of additional power during the dry season. The winter was unduly prolonged and the steam plants had to be started up in the second half of March of this year.

Shanghai Electric Construction Co., Ltd.

The directors' report for 1924, which was to be presented at the annual meeting on Wednesday last, recorded an operating profit of £109,119—the highest yet attained. After adjustment for exchange, London expenses, &c., the net profit was £104,770, and to this is added £24,394 brought forward, making £129,164. Of this amount £1,500 is provided for corporation profits tax, £20,000 for renewals, and £1,401 for staff provident fund, leaving £100,263. Two interim dividends of 6 per cent. each absorbed £48,000, and the directors recommend a final dividend of 8 per cent., making 20 per cent. for the year, leaving £26,263 to be carried forward. The depreciation of subsidiary coinage necessitated a revision of fares during the past year, and a further revision was necessitated and was brought into operation at the end of April last. After careful consideration a chassis for the new trolley 'buses was selected and shipments were commenced in March and are being continued. Concurrently with the railless extensions, the length of the railed track is being slightly extended and a number of improvements are being made to permit of an increased service. Orders already placed will bring the company's passenger vehicles to a total of 300 within a few months. An appeal against increased taxation assessments has been lodged and negotiations with the Inland Revenue Authorities are proceeding. Protracted negotiations for the re-organisation of the Singapore Electric Tramways, Ltd., have now reached a stage at which a satisfactory Traction Ordinance, agreed with the Municipal Commissioners, has passed the Legislature. As soon as it becomes effective steps will be taken for the formation of the new company and the raising of the necessary funds for the re-equipment of the undertaking.

German Companies.

The directors of the *Accumulator Works* Company, of Berlin, recommend a dividend at the rate of 5 per cent. for 1924.

The *High Frequency Machine Company for Wireless Telegraphy* contemplates the payment of a dividend at the rate of 8 per cent. for 1924.

The *C. Lorenz Company*, of Berlin, after placing 623,000 marks to depreciation, proposes to distribute 10 per cent. on the share capital of 6,000,000 marks as compared with 25 per cent. on 1,400,000 marks in 1913.

The *Hartmann and Braun Company*, of Frankfort-on-Main, states that the demand at the beginning of 1924 was less than the productive capacity, but approached this in the course of the summer and considerably exceeded it at the close of the year. After having made provision for depreciation the accounts show net profits of 113,000 marks, and a dividend of 5 per cent. is to be paid on the ordinary shares.

The *United Aluminium Works Company*, which is owned by the State (Reich), after having applied 1,910,000 marks to depreciation, reports net profits of 3,570,000 marks for 1924 and a dividend of 7½ per cent. on the share capital of 20,800,000 marks. The share capital has been increased by 3,200,000 to 24,000,000 marks in order to take over the aluminium installation on the Inn. The production of the works is stated to have amounted to 11,800 tons last year and to have been easily disposed of.

The *Hamburg Overhead Railway Co.* is paying dividends of 6 per cent. on the "A" and 5 per cent. on the "B" shares for 1924. It is proposed to make an issue of £750,000 of "C" shares, according to the *Financial Times*.

French Companies.

The report of the *Société des Forces Motrices du Rhône*, of Lyons, for the last financial year, shows a profit of 7,669,535 fr., as compared with 7,426,416 fr. in 1924. The directors are distributing 3,700,000 fr. to the shareholders, this being equal to a dividend of 9¼ per cent. on the capital of 40 million fr.

The report of the *Société Française Thomson-Houston*, of Paris, shows a net profit of 13,772,477 fr. for the last financial year, as compared with 23,425,486 fr. in 1924. No dividend is being declared.

Barnsley and District Traction Co., Ltd.—The report for 1924 shows a revenue of £184,254, and a balance of £23,461 after meeting expenses, including debenture interest and £8,300 for renewal. To this is added £20,571 brought forward, making £24,032. It is proposed to transfer £10,000 to reserve, to pay a final dividend of 10 per cent., free of tax (making 15 per cent. tax-free for the year), and to carry forward the balance (£23,477).

Lewes and District Electric Supply Co., Ltd.—The surplus on the past year's working was £9,564 and £2,687 is brought forward, making £12,251. From this are deducted administrative expenses, debenture interest, renewals (£2,500), &c., leaving £6,771. It is proposed to pay a 10 per cent. dividend on the ordinary shares, to place £1,000 to reserve, and to carry forward £3,444.

Birkdale District Electric Supply Co., Ltd.—The balance on working for the past year was £15,517. After adding interest (£101) and the balance brought forward (£7,341), and deducting administration expenses, &c., there remains a balance of £18,997. It is proposed to pay a dividend at the rate of 7½ per cent. on the ordinary shares, to place £5,000 to reserve, and to carry forward £10,547.

Yorkshire (West Riding) Electric Tramways, Ltd.—An interim dividend at the rate of 6 per cent. has been declared on the 6 per cent. cumulative preference shares.

Oriental Telephone & Electric Co., Ltd. — The directors recommend the payment of the following final dividends for the year ended December 31st last:—3½ per cent. on the old preference shares, making a total of 7 per cent. for the year; at the rate of 3½ per cent. per annum on the new preference shares, making a total dividend at the rate of 7 per cent. for the year; 6 per cent. on the old ordinary shares (free of tax), making a total of 10 per cent. for the year (free of tax); at the rate of 6 per cent. per annum on the new ordinary shares (free of tax), making a total dividend at the rate of 10 per cent. (free of tax) for the year.

Stock Exchange Notices.—The undermentioned have been ordered to be officially quoted:—

Bournemouth and Poole Electricity Supply Co.—150,000 ordinary shares of £1 each, fully paid, Nos. 400,001 to 550,000.

Tottenham District Light, Heat and Power Co.—£150,000 five and a-half per cent. preference stock (irredeemable).

Application has been made to the Stock Exchange Committee to allow the following to be officially quoted:—

Tokio Electric Light Co.—£600,000 six per cent. sterling bonds, Nos. 16,251 to 19,500.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Colne Valley Electric Supply Co.—£75,000 5½ per cent. debenture stock.

Submarine Cables Trust.—The annual meeting of the trust was held on May 26th. In moving the adoption of the report (*vide* our last issue), the chairman, Sir John Denison-Pender, said that the revenue from dividends was lower owing to the smaller dividends on American holdings, due partly to the appreciation of sterling and partly to the receipt of four dividends, as against five in 1923, from the Mackay Companies. Up to date 3,657 certificates had been redeemed out of the original total of 4,200. The balance, 543, should be redeemed within the next two or three years, provided that the income was maintained at its present level.

Calcutta Tramways Co., Ltd.—The report for 1924 shows a net revenue of £228,047 (including £5,453 brought forward). After providing for preference dividends and debenture interest, the directors propose to allocate £60,000 to depreciation, £31,000 to general reserve, £5,000 to suspense account, and £2,030 to staff provident fund. A final dividend of 6 per cent., free of tax, is recommended on the ordinary shares, making 10 per cent., tax-free, for the year (as against 7½ per cent.), and £14,267 is to be carried forward. Meeting, June 9th.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—The report for 1924 states that the gross revenue was £1,974,261, and the balance on working £1,055,767. Deducting taxation and debenture interest, and adding £412,245 brought forward, leaves a surplus of £1,259,141. From this balance £450,000 has been transferred to general reserve; a total distribution of 10 per cent., free of tax, has been made; and a balance of £409,141 remains to be carried forward. Meeting, June 11th.

Merthyr Electric Traction and Lighting Co., Ltd.—The report for the past year records a revenue of £29,550. The balance available, after meeting expenses, debenture interest, and allocation to renewals (£10,000) and adding £4,293 brought forward, is £13,305. It is proposed to pay a dividend of 7 per cent. on the ordinary shares, to transfer £2,000 to reserve, and to carry forward £4,929.

Yorkshire (Woollen District) Electric Tramways, Ltd.—The revenue for 1924 was £162,596, and after deducting expenses, including £23,700 for renewals, there remains a surplus of £30,164. The addition of £27,935 brought forward renders £58,099 available, and it is proposed to transfer £10,000 to reserve; to pay a dividend of 6 per cent. on the ordinary shares; and to carry forward £35,199.

Ferguson, Pailin & Co., Ltd.—To meet expenditure upon new extensions at the Openshaw works, and for the general purposes of the company, the directors are issuing to shareholders the remaining 7,814 seven per cent. cumulative participating preference shares and 17,624 ordinary shares of the nominal value of £1 each, at £1 5s. per share.

Mirrlees, Bickerton & Day, Ltd.—The net profit for 1924, after providing for depreciation and directors' fees, was £17,811. To this is added £6,779 brought forward, making £24,590. It is proposed to pay a dividend of 7½ per cent. on the ordinary shares, and to carry forward £7,033.

Melbourne Electric Supply Co., Ltd.—At meetings of the holders of the various classes of the company's debenture stocks, held on May 27th, extraordinary resolutions were passed unanimously approving the agreement between the company and the Victorian Government.

Aron Electricity Meter, Ltd.—A dividend of 9 per cent. is recommended on the 6 per cent. preference shares, making 12 per cent. for the year, of which 6 per cent. is in respect of arrears. It is also proposed to pay a dividend of 3 per cent. on the ordinary shares—the first since the year 1913-14.

Western Telegraph Co., Ltd.—The directors have declared the third quarterly interim dividend of 5s. per share, free of tax, for the year ending June 30th, being at the rate of 10 per cent. per annum.

British Electric Traction Co., Ltd.—The directors have declared a final dividend of 5 per cent. on the ordinary shares, making 7 per cent. for the year, as compared with 6 per cent. in 1923-24, and 5 per cent. in 1922-23.

Stocks and Shares.

TUESDAY MORNING.

THE Stock Exchange calculates that members make their bread between June and September inclusive. The butter and the jam have to be provided from the receipts of the other eight months of the year. Which is, of course, a homely way of saying that the four months that lie ahead are not expected to produce more than a moderate volume of business. Rubber shares look like giving the markets a "run for their money," so to speak, but there are no other features that make for exhilaration. Money in plenty seems to be available for new issues, a condition of which advantage is likely to be taken by various large electrical undertakings in the near future.

Several plain hints have recently been dropped by those connected with power companies, to the effect that development demands money and that capital accounts will have to be expanded in order to cope with work that offers wide scope for the employment of labour as well as of money. Cable manufacturing companies are amongst those which contemplate new issues. Callender's are to make an allotment of shares at a price which will provide proprietors with a pleasant bonus. The United River Plate Telephone is taking powers to create a fresh million pounds of capital, though this is not coming immediately. The County of London Electric Supply Company has an ambitious programme—and an issue of short-term debentures shortly falling due.

The Shropshire, Worcestershire and Staffordshire Company intends to replace its 7 per cent. redeemable preference shares with another issue, of 6 per cent. cumulative preferences, that will save money in the annual interest-service. At the company's meeting last week, the chairman, Mr. Garcke, pointed out the extra cost laid upon users of electric current by the Government's refusal to allow high-pressure lines on the highways. The alternative of wayleaves is, Mr. Garcke contended, expensive and avoidable.

Aron Electricity Meter has declared the long-awaited dividend which clears off the arrears on the preference shares. This comes to 12 per cent. in all, for the year ended March 31st last. At the same time the ordinary are given 3 per cent., the first distribution they have received since 1914. The market promptly responded with rises to 17s. in the preference and to 13s. 9d. in the ordinary, but people who wanted to buy the shares found no supply on offer. The manufacturing group of shares is firm, with Siemens better at 27s. 6d. This followed the meeting, at which the chairman spoke hopefully of the extension of automatic telephony. His remarks had the effect of strengthening Automatic Telephone shares by 2s. 6d.; the price has risen to 2¼. International Telephones remain neglected at 24s. 6d., interest in these being restricted by the provision under which the shares can be taken over at 30s. by a firm of American financiers. Marconis arouse no particular attention, but Marconi Marines eased off to 21s. 3d. middle.

Charing Cross ordinary, City "Lights" and Westminsters, are better. Edmundson's preference fell 1s. and the Newcastle-on-Tyne Electrics are rather easier. Melbourne Electrics at 147 have gained 2 points.

British Columbia Electric deferred is a firmer market at 108¼. Anglo-Argentine Trams are unaffected by the issue of a report showing an advance in net revenue of £68,500, which is utilised to fill up the gap made a year ago in order to meet the dividend on the second preference shares, &c. The ordinary shares have received no dividend since the war broke out, and the friction between the Municipality of Buenos Aires and the company has not yet been composed. Until some agreement is reached, the company naturally cannot raise more money for the extensions of the tramway system which the Municipal Council requires, and in this unsatisfactory condition the state of affairs still stands.

British Electric Traction preference has gone up 2, to 100½. This is the only movement in the home section. Metropolitan Consolidated and Districts are both ¼ down. Underground Electrics keep steady. The establishment of parity between pound sterling and dollar brings nearer the feasibility of a scheme of reorganisation of the Underground Company's finances. Often suggested and greatly desired, the proposal was rendered almost impossible by the gold premium that has disappeared but recently.

Eastern Telegraph stock and Eastern Extension shares are none the better off by reason of annual reports that disclose improvement in net takings. The regular dividends of 10 per cent. free of tax are maintained. The Eastern Company has concluded arrangements for working its subsidiaries, the Eastern and South African, West African, and Europe and Azore Telegraph Companies, as from January 1st this year. The intention is to effect economies in operation. The market in cable issues is quiet: a certain amount of stock has lately come in on account of deceased holders' estates. Rubber shares, as already mentioned, are animated and strong owing to the price of the raw material having risen to a shade above 3s. per lb. for cash. The prices for later dates are less, a fact which induces caution in people who infer from this that the market may be somewhat artificial. Iron, steel and "armaments" have taken on a brighter aspect the speculative investor being inclined to pick up shares after the long fall in prices.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1923.	Dividend. 1924.	Price May 29 1925.	Rise or fall.	Yield p.c.
Bournemouth and Poole ...	1	13	14	2½	—	4 10 7
Brompton Ordinary	1	10	10	1½	—	*6 14 8
Charing Cross Ordinary	1	14½	15	46/9	+6d.	6 8 2
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	1½	—	6 8 6
City of London	1	15	15	43/3	+ ⅛	6 4 9
do. do. 6% Pref. ...	1	6	6	23/6	—	5 2 9
Clyde Valley	1	8	8	32/6	—	4 18 6
County of London	1	15	15	9½	—	5 9 1
do. do. 6% Pref. ...	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	—	23/6	—	5 19 0
do. 7% Pref.	1	6	7	22/-	—1/-	6 7 3
Elec. Supply Corporation ...		10	10	33/3	—	6 0 4
Kensington Ordinary	5	14	15	128	—	5 16 6
Lancs. Light and Power ...	1	7½	7½	27/-	—	5 11 1
London Electric	1	10	10	34/6	—	5 15 11
do. do. 6% Pref. ...	5	6	6	5¾	—	5 6 8
Metropolitan	1	10	11	38/3	—	5 15 0
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	24/3	—	4 19 0
Newcastle-on-Tyne Ordinary ...	1	6	7	22/-	—6d.	6 7 3
do. 5% Pref. ...	1	5	5	18/9	—	5 6 8
do. 7% Pref. ...	1	7	7	25/-	—6d.	5 12 0
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref. ...	1	6	6	1¼	—	5 6 8
St. James' and Pall Mall ...	5	17½	17½	102	—	6 8 8
South London	1	15	15	2½	—	6 0 0
South Metropolitan Pref. ...		7	7	1¼	—	5 12 0
Urban Ordinary	1	4	4	17/6	—	4 11 5
do. 6% Pref. ...	1	6	6	20/-	—	6 0 0
Westminster Ordinary	1	15	15	46/6	+1/-	6 9 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	19/6	—	7 13 10
Yorkshire Elec.	1	8	8	31/-	—	5 3 3

HOME RAILS.

Central London Ord. Assented	Stock	4	4	60	—	6 15 11
Metropolitan	,,	4	5	75	— ½	6 13 4
do. District	,,	3½	3½	48½	— ½	7 4 4
Underground Electric Ordinary	10	Nil	Nil	2½	—	Nil
do. do. "A" ...	1/-	Nil	Nil	8/-	—	Nil
do. do. Income	Bonds	6	6	97	—	*6 3 9

TELEGRAPHS AND TELEPHONES.

		Dividend. 1922.	Dividend. 1923.			
Anglo-Am. Tel. Pref.	Stock	6	6	105	—	5 14 2
do. Def.	,,	1½	1½	24⅜	—	6 3 1
Automatic Telephone	1	Nil	3	2½	—	2 18 1
Chili Telephone	5	6	6	5⅞	—	*5 7 10
Cuba Sub. Ord.	10	7	5	6¾	—	7 5 6
Eastern Extension	10	10	10	17½	—	*5 12 8
Eastern Tel. Ord.	Stock	10	10	175½	—2	*5 14 0
Globe Tel. and T. Ord.	10	10	10	18	—	*5 11 1
do. do. Pref.	10	6	6	11½	—	5 7 10
Great Northern Tel.	10	24	22	33	—	6 17 6
Indo-European	25	7	7	41½	—	*4 4 4
Marconi	1	15	10	1⅛	—	5 19 7
Marconi Marine	1	10	10	1⅛	— ⅛	9 8 2
Oriental Telephone Ord. ...	1	12	12	9½	—	*5 16 3
United R. Plate Tel.	5	8	8	7⅛	—	*5 13 3
Western Telegraph	10	10	10	17	—	*5 17 5

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	12½	5½	3½	—	8 9 2
do. do. 2nd Pref. ...	5	5½	6	2⅜	—	10 7 10
do. do. 5% Deb. ...	Stock	5	5	7⅜	—	6 17 0
British Electric Traction Ord. ...	,,	5	6	112½	—	5 5 0
do. do. 6% Pref. ...	,,	6	6	100½	+2	5 9 7
Brazil Traction	100	4	4	55¾	—	7 4 2
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	,,	5	26/-	89½	—	*5 7 3
do. do. Deferred	,,	8	129/5	108½	+1	*5 19 2
do. do. Deb.	,,	4½	4½	77½	—1	5 9 8
Lond. & Sub. Trac. 5% Pref. ...	1	5	2½	6/6	—	Nil
London United Tram. Deb. ...	Stock	4	4	47½	—	8 8 5
Mexico Trams, 5% Bonds ...	—	Nil	5	66	—	7 11 6
Mexican Light Common ...	100	Nil	Nil	27	—	Nil
do. Pref.	100	Nil	Nil	61	—	Nil
do. 1st Bonds ...	—	5	5	67½	—	7 8 2
Yorkshire (West Riding) ...	1	—	5	18/9	—	5 6 8

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	20	12	2⅜	—	*4 8 1
British Aluminium Ord.	1	5	5	22/6	—	8 1 6
British Elec. Transformer Pref.	1	Nil	Nil	17/6	—	... ...
British Insulated Ord.	1	15	15	3¼	—	4 10 3
Brush Ord.	1	10	10	22/6	—	8 17 10
Callenders	1	15	15	3⅞	—	4 10 7
do. 6½% Pref.	1	6½	6½	23/9	—	6 9 8
Crompton Ord	1	5	Nil	¾	—	... ...
Edison-Swan	4/-	7½	10	7/9	—	5 1 7
do. 5% Deb.	Stock	5	5	83½	—	6 1 3
Electric Construction	1	10	10	33/9	—	5 19 10
Enfield Cable, Pref.	1	7½	7½	1½	—	6 0 0
English Electric	1	8	5	18/-	—	6 11 1
do. do. Pref.	1	6	6	21/-	—	5 14 8
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	5	5	20/9	—	4 4 3
Henley	1	15	15	3¾	—	4 12 4
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	10	5	1½	—	*4 8 11
Johnson & Phillips	1	5	10	1½	—	5 10 4
Met-Vickers, Ord.	1	12½	8	23/3	—	6 17 8
do. Pref.	2	8	8	2⅜	—	6 14 9
Siemens Ord.	1	5	—	27/6	+6d.	*4 12 9
Telegraph Construction	12	20	20	27/-	—	8 14 6

* Dividends paid free of Income Tax.

Norwegian Trade and Industry.

Harbour Troubles in 1924.

MR. C. L. PAUS, C.B.E., British Commercial Secretary at Oslo, has forwarded to the Department of Overseas Trade a report upon the economic and industrial conditions in Norway dated February, 1925.*

The report is prefaced with a quantity of miscellaneous information from which it is gathered that the latest available returns show a population of 2,650,000 (rural 1,860,000); that there are only six towns with a population of more than 16,000 (Oslo having 258,480 inhabitants), and six others with populations of between fifteen and sixteen thousand; and that the chief importers and business men correspond in English. Norway has an adverse trade balance, the imports in 1924 amounting to kr. 1,547,814,000 and the exports to kr. 1,063,696,000. Great Britain was the second largest exporter to Norway and the country's principal customer, there being a slight balance in our favour.

Finance and Labour.

During 1924 anxieties connected with the State and municipal finances forced themselves into the foreground with increasing urgency. Although there was no repetition of the banking crisis of 1923, certain important banks were placed under administration and the public was very nervous. Extreme stringency characterised the money market, and a further heavy depreciation in the average value of Norwegian currency was recorded, but there was a rise of the krone at the end of the year. In spite of these difficulties, however, exports increased and industries working for the home market improved their position as a whole, even if this improvement was largely due to increased protection.

In March, 1924, there was a serious labour conflict arising out of a strike for higher pay on the part of dockers at the principal ports. This gradually widened until 60,000 men were involved. Work came to a standstill in all the most important industries of the country, including the pulp and paper mills, mechanical and electrical workshops, the electro-chemical industry, &c. In the meantime a strike in the iron and steel industry had been in progress since October, 1923. The whole of the strikes were settled in May, 1924, with the exception of the transport strike, which lasted until the end of June. Legislation designed to prevent strikes was laid before the Storting in July, but a change of government postponed this indefinitely.

Industry and Trade.

During the year covered by the report the works producing electrical machinery were better occupied, although they were seriously affected by the above-mentioned strike. In spite of the preference usually given to Norwegian products, orders for two large turbines were placed in Germany by the Government. Certain nitrate factories which had remained stationary for a number of years resumed operations and others are to be re-opened, in some cases by foreign interests. German and American capitalists are said to be studying the possibilities of exploiting the hydro-electric power for productive purposes; this would appear to indicate the possibility of a new period of progress for electro-chemical and electro-metallurgical industry in Norway. The report states that the outlook in the engineering industries is now regarded as somewhat brighter; concerns are better occupied and operations are being resumed in a number of factories which were practically idle.

An appendix to the report, showing the exports for the years 1923 and 1924, indicates that the exportation of generators and dynamos fell from 20,327 to 120 kg. Exports of electric motors are given as 18,506 kg., there being no figure for 1923. There was an increase in the amount of telephone and telegraph apparatus exported from 10,658 to 14,633 kg. The figures for hoists, elevators, cranes, and other goods-handling apparatus show a fall of 115,372 kg. to 39,265 kg. In the imports list under the general heading of "Machinery," imports are given as 41,419,055 kr. in 1924 and 37,368,200 kr. in 1923.

Hydro-Electric Power.

The technical plan for the organisation of the supply of electricity on a national basis, which was submitted last year to the Ministry of Public Works by a Government Commission appointed in 1918, is still under consideration. No new schemes were initiated by the State or municipalities in 1924, but further advance was made in the utilisation of available energy by the inter-connection of existing power stations, and work was continued upon the completion of earlier schemes. Financial difficulties have, however, as in previous years, proved a serious obstacle in the way of municipal enterprise. At Nore, where operations have been carried on for a number of years by the Government, the process of tunnelling is nearly completed and the levelling of the site for the power station has been commenced. Sums of kr. 2 million in aid of this scheme, and of kr. 3.5 million for the Numedal railway, were granted by the State in 1924. It is hoped that by 1926 the construction of the railway will be so far advanced that it will be possible to transport the heavy plant to the power station, and that in 1928 the installation of two 23,000-kW sets will be completed.

The joint scheme of the State and the Oslo municipality to harness the Solbergfos on the River Glommen has encountered various delays, but three 13,000-kW units have now been started up. Four similar sets are to be installed.

Some progress was made during the year with the scheme of the Bergen municipality to harness 100,000 h.p. at Dale. Among the smaller schemes may be mentioned the Heggmo station at Bodin (7,000 h.p.), which is now ready for use; the scheme of the Fredrikshald municipality employing the Brekke and Krappeto waterfalls has also been completed; and a municipal company has harnessed the Aavella waterfall to produce 3,000 h.p.

With a view to facilitating the completion of municipal power schemes, the Storting granted in 1924 authority to the Government to guarantee the repayment of loans, up to a total of kr. 6.5 million, for the completion of plant for which the Government had already incurred responsibility.

The only railway electrification work which is proceeding is that on the section between Bragerōen (nr. Drammen) and Kongsberg (48 km.), and on the Hovedbane between Oslo and Lillestrōm (21 km.). No decision has yet been reached with regard to the electrification of other sections of railway.

Broadcasting.

The Ministry of Commerce was authorised in October last to grant to a company then about to be formed, a licence to establish and operate broadcasting stations, and to fix a date from which the right to sell or hire out receiving apparatus should be subject to a licence granted by the Director of Telegraphs on certain conditions. December 15th was the date decided upon, and a scale of dues payable on receiving apparatus sold in Norway was fixed and dealers were ordered to pay an annual due of kr. 20.

On November 26th the public was invited to subscribe to a broadcasting company styled "Kringskastingselskapet A/S," with headquarters in Oslo. The promoters included a number of the leading companies, including the Norwegian Marconi, Telefunken, Western Electric, and Telegrambyraa concerns. The capital was kr. 350,000, of which kr. 121,000 was subscribed by the promoters. The maximum capital was subscribed by January 16th last. The Ministry of Commerce was prepared to grant a concession to the company for five years on terms which provided, among other things, that shareholders should not receive more than 7 per cent. cumulative dividend or be repaid more than the original face value of their shares, that no foreigner should hold shares without the Ministry's consent, and that the Ministry should nominate a member of the board. The company intended to employ a standard "Q"-type Marconi station, with a wavelength of between 300 and 500 metres.*

Commercial Law.

A Bill to revise the Commercial Law of 1907 was presented to the Storting last year, and at the date of the report was under consideration by a committee. The following are among the provisions of the Bill:—(1) In order to be regarded as "inhabitants of the kingdom," within the meaning of the law, foreigners must reside in Norway for two years instead of one year as at present. (2) The grant of trading licences is made subject to more stringent conditions. (3) All responsible partners and members of boards of "Commandit" share companies, and all directors of share companies and other limited liability companies, must be inhabitants of the kingdom. (4) Foreign commercial travellers visiting Norway must take out police licences valid for 30 days, which cost kr. 200 for the first firm represented and kr. 50 each for other firms. (At present such licences cost kr. 100, irrespective of the number of firms represented.)

The Care of Igniter Pins on Safety Lamps.—A circular has been issued by the Mines Department to the managements of mines where flame safety lamps fitted with electrical igniter pins are in use, emphasising the necessity of maintaining the pin and its fittings in good repair, and of examining them carefully before they are allowed to be used. Two alarming accidents have occurred within the past 12 months due to neglect in this direction. In one case an explosion of firedamp occurred, and it originated, without doubt, at a collier's safety lamp. At this colliery, some of the igniter pins were not replaced as they became worn or loose. Instead, the brass tube through the oil vessel (which normally held the pin and its ebonite bush) was closed up by a solder plug. This plug came out, unnoticed, from the lamp, and the explosion was the result, the diameter of the tube being sufficiently large to allow flame to pass through it. In the other case a fireman, in the course of his inspection, lit gas with his safety lamp and an explosion resulted which killed him and injured several other persons. The igniter pin and the ebonite bush were missing from the lamp, and there can be no reasonable doubt that either they were missing or they were broken or very badly damaged when the lamp was issued from the lamp room.

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* Stationery Office. 2s. net.

*The company commenced operations towards the end of February.

The Electrical Imports of Chile.

THE following figures, showing the values of the imports of electrical and allied goods into Chile in 1923, are taken from the recently published official trade returns. For purposes of comparison the figures for 1922 are given, and notes of increases or decreases are made :—

	1922. Pesos.	1923. Pesos.	Inc. or dec. Pesos.
Insulators for telegraphs and telephones—			
Total	162 000	346,000	+ 184,000
From United States	81,000	116,000	+ 35,000
,, Gt. Britain	18,000	99,000	+ 81,000
,, Germany	55,000	130,000	+ 75,000
Wire, insulated or sheathed (covered)—			
Total	324,000	545,000	+ 221,000
From Germany	189,000	332 000	+ 143,000
,, Japan	13,000	—	– 13,000
,, United States	35,000	120,000	+ 85,000
,, Belgium	9,000	29,000	+ 20,000
,, Gt. Britain	53,000	38 000	– 15,000
Incandescent electric lamp bulbs—			
Total	740,000	983,000	+ 243,000
From Germany	333,000	464,000	+ 131,000
,, United States	160,000	231,000	+ 71,000
,, Holland	174,000	229,000	+ 55 000
,, Gt. Britain	51,000	27,000	– 24,000
Apparatus (various) for electric lighting—			
Total	998,000	874,000	– 124,000
From United States	248,000	242,000	– 6,000
,, Gt. Britain	381,000	139 000	– 242,000
,, Germany	333,000	438,000	+ 105,000
Telephone apparatus—			
Total	242,000	338,000	+ 96,000
From Gt. Britain	65,000	111,000	+ 46,000
,, Germany	82,000	66,000	– 16 000
,, Belgium	8,000	—	– 8,000
,, United States	46,000	86,000	+ 40.000
,, Sweden	23,000	45,000	+ 22,000
Telegraph apparatus—			
Total	23 000	114,000	+ 91,000
From Germany	9,000	25,000	+ 16,000
,, Argentina	4,000	1,000	– 3,000
,, United States	3,000	29,000	+ 26,000
,, Gt. Britain	6,000	27,000	+ 21,000
Wireless apparatus—			
Total	367 000	123,000	– 244,000
From Gt. Britain	345,000	7,000	– 338,000
,, Germany	—	15,000	+ 15,000
,, United States	—	65,000	+ 65,000
Electric cables—			
Total	4,163,000	1,328,000	–2,835,000
From Germany	299,000	162,000	– 137,000
,, United States	962,000	701,000	– 261,000
,, Gt. Britain	2,742,000	457,000	–2,285 000
Electric bells and parts thereof—			
Total	11,000	18,000	+ 7,000
From Germany	7,000	15,000	+ 8,000
,, United States	—	1,000	+ 1,000
,, Great Britain	3,000	1.000	– 2,000
Pipes and tubes, insulated, for electrical purposes—			
Total	51,000	58,000	+ 7,000
From Germany	39,000	53,000	+ 14,000
,, United States	8,000	2,000	– 6,000
,, Gt. Britain	2,000	1,000	– 1 000
Carbons for electrical purposes—			
Total	62,000	50,000	– 12,000
From United States	—	12,000	+ 12,000
,, Gt. Britain	50,000	30,000	– 20,000
,, Germany	11,000	5,000	– 6 000
Dynamos, motors and parts thereof—			
Total	2,281,000	1,998,000	– 283,000
From Germany	273,000	1,103,000	+ 830,000
,, United States	1,716,000	556,000	– 1,160,000
,, Gt. Britain	239,000	257,000	– 18,000
,, France	1,000	19,000	+ 18,000
Electric lamps (other than incandescent)—			
Total	97,000	120,000	+ 23,000
From Germany	59,000	89,000	+ 30,000
,, United States	12,000	17,000	+ 5,000
,, France	2,000	6,000	+ 4,000
,, Gt. Britain	17,000	3,000	– 14,000
,, Holland	1,000	1,000	—
Meters—			
Total	157,000	203,000	+ 46,000
From Germany	41,000	78,000	+ 37,000
,, United States	11,000	46,000	+ 35,000
,, France	2 000	7,000	+ 5,000
,, Gt. Britain	99,000	69,000	– 30,000
Cells and accumulators—			
Total	365,000	442,000	+ 77,000
From Germany	64,000	100,000	+ 36,000
,, United States	96,000	176,000	+ 80,000
,, Gt. Britain	166,000	132,000	– 34,000
Posts for supporting electric wires and cables—			
Total	137,000	65,000	– 72,000
From United States	1,000	31,000	+ 30,000
,, Gt. Britain	35,000	32,000	– 3,000
,, Germany	100,000	1,000	– 99,000
Electric fans—			
Total	3,000	30,000	+ 27 000
From Germany	1,000	25,000	+ 24,000
,, United States	—	5,000	+ 5,000
Electrical machinery, apparatus and parts (unspecified)—			
Total	3,012,000	3,214,000	+ 202,000
From United States	2,220,000	1,767,000	– 453,000
,, Germany	202,000	561,000	+ 359,000
,, Gt. Britain	489,000	744,000	+ 255,000

[Peso = 1s. 6d.]

The Columbian Market for Electrical Goods.

IN a French official report on the market for electrical material in Colombia it is remarked that French manufactures have not yet obtained a footing there, the United States and Germany being undoubtedly the predominant suppliers. This comment applies both in Medellin and Bogotá. There are, however, numerous opportunities which may be summarised as follows :—(1) The lighting of small towns and villages to the capacity of from 500 to 1,000 lamps.—In order to obtain such orders as these, it is necessary to get into communication with the municipalities and the governors of the principal towns. The despatch of catalogues is quite useless. A visit to the locality is necessary, coupled with the examination of the water power to be utilised, this being the general source of energy. A preliminary scheme drawn up on the spot, with an approximate estimate of costs, will nearly always induce a decision to purchase if the proposal is made at an opportune moment. (2) Small dynamos and accessory plant for medium-sized industrial installations.—Coffee plantations constitute the chief source of Colombia's wealth, and the various operations, such as drying and separating, are all carried out mechanically. Water power is used, and medium-sized dynamos ought to sell well on these plantations, as well as in the sugar districts. (3) Small appliances for the household.—Domestic electrical apparatus is in demand to a limited extent in the towns. The schools and small manufacturers in the towns are, however, desirous of becoming independent of the supply companies. In Bogotá there is good sale for appliances operated by small petrol-driven units. The terms imposed by the electricity supply companies are said to be onerous, and numbers of people are desirous of obtaining independent plant. The prices for the hire of such articles as irons, sewing machines, fans, and electric signs are high. (4) Lamps and fittings.—All electric lamps appear to be of either German or American origin. The bayonet type of fitting is not suitable, screw sockets with the switch on the socket being universal in Colombia. Customers have to accept the installation made by the supply company. It is possible for them to supply their own material, but the company insists upon installing it. Lamps, ceiling roses, electroliers, &c., are sold either by the supply companies or by the ironmongers.

The report emphasises the desirability of supplying agents with samples of every article which it is desired to sell. Undoubtedly, it is added, a sample room is the best means of enabling prospective buyers to compare quality and price. There is not yet any large inquiry for heavy plant, as the more important companies generally make purchases through their representatives in the country of supply. For the present the best chances arise in connection with small dynamos and transformers, wires and cables of superior quality suited to a damp, tropical climate, together with the apparatus mentioned above.

Two New Eversheld Instruments.

Earth Continuity Tester.

A new instrument for testing the continuity of bonding has been developed recently by Messrs. Eversheld & Vignoles, Ltd., to comply with the regulations of the Coal Mines Act relating to tests on joints, &c., in earth circuits in collieries and mines. These tests are most necessary; they ensure that all the external metal portions of electrical apparatus are maintained at earth potential, and also that the earthing circuit is continuous and capable of carrying any leakage current to which it may be subjected. The continuity tester employs a testing current of from five to ten amperes, and tests bonds under approximately working conditions.

Many attempts had been made to make use of the fact that an ordinary ammeter can be utilised to measure resistance if compensation is provided for fluctuations in the testing pressure. The difficulty, however, has been to provide this compensation without affecting the accuracy of the readings. The Eversheld tester is a specially calibrated ammeter, giving

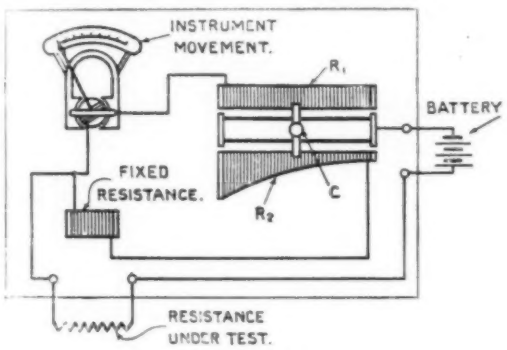

Fig. 1.—Theoretical Diagram.

resistances directly in fractions of an ohm. The pressure compensation difficulty is overcome by the use of an ingenious device designed by Mr. C. Midworth. The arrangement of the instrument is shown in fig. 1. The adjustment consists essentially of a double variable resistance, R_1 and R_2, connected by a sliding contactor C, R_1 being in series with the indicator movement, while R_2 forms part of a shunt circuit. The connections of the double resistance are arranged in such a way that R_2 decreases as R_1 increases, and *vice versa*, R_1 being uniformly wound while R_2 is specially shaped to maintain the total internal resistance of the instrument circuit at a constant value whatever the position of the sliding contactor C may be. By the use of this device, therefore, the resistance

Fig. 2.—External View of the Continuity Tester.

R_1 which controls the sensitivity of the instrument may be varied within wide limits and so compensate for pressure variations without affecting the accuracy of the instrument.

The instrument is made up in a compact form, the indicating instrument, battery, and compensating device being combined as a self-contained unit fitted with a strong carrying handle (fig. 2). Two testing spikes are provided, together with flexible leads of sufficient length for all ordinary tests. These spikes are fitted in special holders at the back of the continuity tester when not in use.

The battery is of the nickel-iron type, which provides a heavy testing current for short periods and is reliable in use; the maximum e.m.f. of this type of cell is 1.5 V.

The compensator must always be adjusted before a test, and in order to provide an accurate method of adjustment, the instrument is fitted with a copper test plate against which the two testing spikes are pressed, the compensator handle being turned until the indicator needle shows a zero reading. The dial of the instrument and the compensator knob are clearly marked so as to indicate the correct direction in which the adjustment should be made according to whether the battery voltage is high or low. This method also allows for the resistance of the leads, which may be in excess of the bond resistance under test. As the tester has to indicate the resistance of both bonds, good and faulty, it is constructed as a two-range instrument, the lower range reading, say, from 0 to 0.05 ohm and the upper range 0 to .5 ohm (or other ranges as specified). The scale consists of fifty nearly equal divisions, thus giving a clear reading at all parts of the range. The instrument is intended for work under extremely arduous conditions; it is of very sturdy construction, and particular attention has been paid to the necessity for making the instrument as dust-proof as possible. The plug contacts are of such a design that they are automatically cleaned every time the plug is placed in position and cannot therefore become choked with dust.

Recording Dionic Water Tester.

This is a development of the "Dionic" water tester, in the form of a recording instrument, with an ingenious device for compensating for changes of temperature. The liquid to be tested is caused to flow continuously through a tube containing electrodes fixed at a suitable distance apart, and between which current is passed, the conductivity of the liquid, and hence its degree of purity, being recorded on a chart.

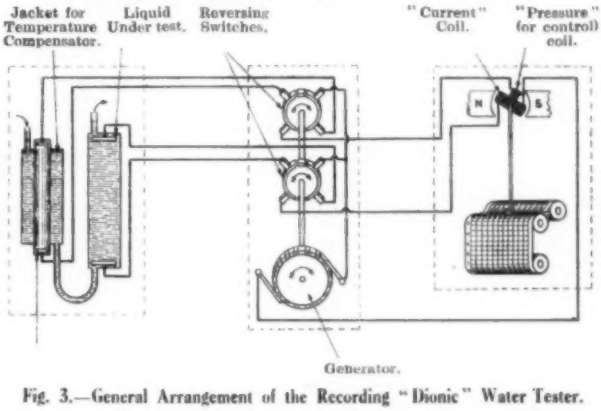

Fig. 3.—General Arrangement of the Recording "Dionic" Water Tester.

The current is provided by a small d.c. generator, which forms part of the equipment, and which is driven by a motor connected to any convenient source of supply.

The recording element is in effect an ohmmeter; its movement consists of two coils mechanically connected together, and mounted on a common axis so that they are free to rotate in the field of a permanent magnet. One of these coils is traversed by a current proportional to the voltage applied to the liquid which it is proposed to test; and the other, which is wound so that it produces a deflecting force in the opposite direction to the controlling force exerted by the first, is traversed by a current from the same source of supply, but is connected in series with the column of liquid, the resultant deflection being proportional to the conductance of the liquid. The temperature compensation is effected by means of a resistance subjected to the same variations of temperature as the liquid under test, and placed in the control circuit of the armature, so that variations in the resistance of the liquid, due to temperature changes, effect current changes in both of the instrument coils proportionally. The resistance consists of a liquid with suitable electrodes in a tube, the tube being placed in a cylindrical jacket through which the liquid under test is flowing.

The movement of the recorder requires unidirectional current for its operation; but electrolytic effects prevent the continuous employment of unidirectional current in connection with the liquid resistances. A rotating reversing switch is therefore placed in each of the circuits, between the coils of the instrument and the liquid in series with them, rendering the currents unidirectional when they pass through the coils, but alternating when they pass through the liquids. The reversing switches are mounted on a common shaft, and are arranged so that both circuits are simultaneously commutated.

A diagram, illustrating the general principles of the instrument, is given in fig. 3.

The Electrical Manufacturing Industry.

Official Evidence before the Balfour Committee.

At a meeting of the Committee on Industry and Trade (Sir Arthur Balfour, Chairman), held at the Board of Trade on May 27th, evidence was submitted by Mr. D. N. Dunlop, the director of the British Electrical and Allied Manufacturers' Association. Mr. Dunlop said that high costs of production had been a serious factor in reducing the competitive power of the industry, and that it was only through retention of high quality in manufacture and plant efficiency, coupled with scientific co-ordination of activities, that the industry had been able to overcome some of the disadvantages resulting from this.

Costs of Production.

Wages had risen by 100 per cent. over the period 1913-1923; local taxation 220 per cent.; imperial taxation 680 per cent.; all taxation 502 per cent.; materials 60-70 per cent.; and the total costs of production 83 per cent. There was a tendency in 1924 for wages and materials to rise higher still, with the result that the position was worse than in 1923. A great part of this increase, in wages at least, had been caused by the high cost of living in Britain and there was no doubt that, from this point of view alone, Britain was suffering from a great disadvantage in international competition. Mr. Dunlop stated that in December, 1924, for example, the cost of living index on a gold basis in Britain stood at 173.7, compared with 123.0 in Germany, 105.4 in France, 127.6 in Italy, and 94.8 in Austria, and the witness contended that in the distribution of production costs the higher prices paid in Britain for labour and for materials were sufficient to cover the difference in value of output between the French worker and the British worker, the margin of profit remaining to the French manufacturer being the same. This meant that the French manufacturer could quote prices 25-30 per cent. below the British prices and have the same profit.

The Effect of Taxation.

Taxation, Mr. Dunlop stated, had added greatly to the proportion of overhead expenditure included in the total costs. Prior to the war it represented 1.5 per cent. of the total output of the industry, but in 1923, with an output 113 per cent. greater, it represented 4.7 per cent. The effect of this had been to deprive the industry of that profit margin which would meet the charges on new capital essential to continuous development and to continuous efficiency of production. Industry bore too heavy a proportion of the taxation levied in the country and a more equitable distribution of taxation would be the first essential in the restoration of industrial prosperity.

Our Electrical Development Insufficient.

The need for greater national development of electricity was emphasised, since the inability to supply power at low rates to industry was crippling other industries in international competition, and depriving the electrical industry itself of a market for its products in Britain. France was adding to her generating plant at a rate of 700,000 kW per annum while in Britain the corresponding figure was about 450,000 kW. The output of the electrical manufacturing industry in the United States had increased by 200 per cent. during the period 1914-24, in France by 190 per cent. (allowing for a depreciated currency), while in Britain the increase was 113 per cent. If we considered that the output in 1913 was abnormally low in comparison with the output in Germany and the United States, the increase recorded was not satisfactory. With the same relative development as in the United States, the industry could have found employment for more than twice the number of workers actually engaged and so contributed in no small measure to the solution of the unemployment problem.

Our Foreign Trade.

Mr. Dunlop stated that the record of the electrical industry in the foreign market since 1913 was comparatively good owing to the recognition of the high quality of the plant exported. Its share in the world market had risen from about 21 per cent. in 1913 to 25.3 per cent. in 1923, due almost exclusively to the immense electrical development that had taken place in the Dominions. Outside of the Dominions there had been practically no change during the period 1913-23, due largely to the reduction of demand from Europe which had now only 50 per cent. of its pre-war value. The growth of national production, the increase of protective tariffs and the economic chaos which had set in since the conclusion of the war had had serious consequences for the electrical industry.

The Cable Industry.

Evidence was also given upon the British insulated electric cable industry by Mr. L. B. Atkinson, director of the Cable Makers' Association, which, the witness stated, represented over 90 per cent. of the output of the industry. Mr. Atkinson stated that the total production in the industry to-day for home consumption and export, after allowing for the different price level, was about twice that existing before the war (1914).

He explained that the industry had been built up during the last 25 years under an Association which had brought about a very complete standardisation and specialisation of products, and he claimed that, by the employment of trade designs and trade marks common to all the manufacturers, and by always working to produce a product of the highest possible quality the Association had established for British electric cables a very high reputation throughout the world. The Association also concerned itself with co-operative research which had yielded some very valuable results, as well as with the collection and use of statistics. Labour matters were dealt with through a Joint Industrial Council, under which the wages and conditions of employment and the automatic variation of wages with changes in the cost of living were provided for by agreements.

Mr. Atkinson also mentioned that the Association co-operated under agreement with the distributing trades and with the electrical contractors carrying on installation work. He explained that although there was no co-operative marketing in the industry, there was a co-operative propaganda or fostering of markets by Development Associations, in which the manufacturers took a prominent part both for the development of the general consumption of electricity and for the development of the use of the telephone.

Financial Policy of Cable-makers.

Mr. Atkinson claimed that in the matter of price, competition from abroad both in this country and in the export markets, was very severe, and stated that although the volume of trade was greater than in pre-war times, the margin of profits had been considerably cut down of later years. In this connection he alluded to the frequent references in financial and other papers to the prosperous condition of the electric cable industry. Mr. Atkinson contended that this was very largely due to the conservative financial policy adopted in the past which had resulted in considerable amounts of capital in the principal companies being placed there on very low rates of interest, and this, coupled with the small share capitals of the companies, reflected itself in apparently high dividends on that small share capital. He considered, however, that the return measured over the whole capital was comparatively low.

Mr. Atkinson expressed the view that the overseas trade of this industry was seriously threatened, particularly in the Dominions, by the efforts being made to start production in those countries and by the heavy tariffs put on with the view of fostering these industries.

In conclusion, he explained that practically all the raw materials of the industry were imported from abroad, so that the world price must be paid, and that wages in this country were high relative to the same class of skill in other industries, being about double what they were before the war, or about 30 per cent. higher allowing for the difference in the cost of living.

He added that the rates of wages in Continental countries producing cables were considerably lower than in this country, as were the overhead charges from rates and taxes. In consequence the Continent was offering cables at very low prices in England, and Mr. Atkinson stated that a considerable number of orders had been placed abroad of recent times by companies and municipalities.

Mineral Statistics.—In statistics issued by the Imperial Mineral Resources Bureau relating to the mineral industry of the British Empire and foreign countries, it is interesting to note that the production of uranium minerals in the United Kingdom in 1922 was 7,860 cwt., as compared with 1,520 cwt. in 1921 and 1,200 cwt. in 1920, while the total imports for 1922 were 283 cwt., as compared with 5,026 cwt. for 1921. The Belgian Congo exported 4,683 cwt. of uranium metals to Belgium in 1922.

In 1922, 1,082 cwt. of concentrates of molybdenum ore were produced in Australia in addition to 591 long tons of ore, which were produced in Victoria. In 1921 Australia produced only 275 cwt., but in 1920 she produced 2,354 cwt. The United Kingdom imported 3,328 cwt. of molybdenum in 1920, 1,361 cwt. in 1921, and 133 cwt. in 1922, while in 1920 she re-exported 310 cwt., in 1921 618 cwt., and in 1922 4,740 cwt.

In 1922, 2,123 long tons of vanadium ores were produced in the British Empire—1,982 tons in South-West Africa, and 141 tons in Northern Rhodesia.

House of Lords Acoustics.—The second report of the Select Committee on the House of Lords Offices has been issued as a White Paper (125, price 2d.). A sub-committee dealt with a proposal to place in the House acoustic instruments for the use of peers who may have difficulty in hearing the proceedings. It is satisfied that it would be possible to place a receiving instrument on each side of the table without inconvenience, linked by underground wires to ear-pieces, similar to those used for telephones, in any part of the Chamber that might be desired. The First Commissioner of Works is to be requested to give effect to the proposal.

Modern Dock Equipment.

By H. J. DEANE, B.E., M.Inst.C.E., M.I.Mech.E.

(*Abstract of a Paper read before the* INSTITUTE OF TRANSPORT.)

THE paper deals with the modern practice in the installation and maintenance of dock equipment.

The general tendency in all new constructions is to adopt electricity throughout, but where existing docks are already provided with hydraulic mains and pumping plant, to utilise, so far as possible, the existing capital outlay by renewing or extending the existing hydraulically-operated plant. Where the mains, and possibly also the pumping plant, are worn out, the choice is generally in favour of electricity, so that in the long run electricity will supersede hydraulic power.

In the early days of the introduction of electric capstans, a considerable amount of trouble was caused by the deterioration of the insulating material due to the condensation of moisture in the pits in which the operating motors were situated. Various methods, such as the introduction of heating elements into the pits, were tried with a view to preventing the consequent failures, but were not altogether satisfactory until improvements were made in the general design and the windings were suitably impregnated to resist condensation. Another point which gives rise to trouble in certain designs is the use of a slipping clutch between the motor and capstan drum. For capstans of the larger sizes where electric energy is suitable, there is a tendency to use squirrel-cage motors without slipping clutches, as this type of motor can be designed not to suffer if stopped while the full load is on. A type having good points is that in which the driving machinery is operated by oil transmission, the power necessary being generated by an electric motor and suitable variable delivery pump with automatic control. The initial cost of this type of capstan is, however, high, mainly on account of the cost of the transmission gear, but there are cases where its adoption can be justified.

Much controversy has ranged round the relative merits of electric and hydraulic cranes. The beam and freeboard of ships have increased to such an extent that the cranes serving them have to be designed with a corresponding increase in height and out-reach. In the case of electric cranes, this does not involve such heavy weights with a high centre of gravity as is the case with hydraulic cranes of the same range and capacity.

With regard to supplying electricity to electric cranes, the usual methods adopted are either by plug and flexible cable or by bare conductors, either overground or underground. Except in cases where the underground conduits can be left open so that there can be no accumulation of rubbish or water, the slot conduit type with bare conductor wires underground cannot be recommended. Where cranes are situated so that protected bare conductors can be placed under the canopies or verandahs of sheds and warehouses, this form of conductor is undoubtedly the most satisfactory. Alternatively, the next best system is by means of properly-drained plug boxes, either beneath the quay or on the shed sides, with armoured flexible hose fitted to an automatic self-winding drum on the crane itself, so that only so much cable is lying out on the quay as is essential for the purpose. The operation of a large battery of electric cranes requires careful consideration of load factor so that the power circuits and feeder cables may be suitably designed.

In cases where gravity or power-driven conveyors are not suitable, electric battery trucks provide a quick and economical means of transporting goods from the quayside into the warehouse and *vice-versa*. Electric batteries should be fitted which are capable of practically continuous use throughout the working shift without re-charging, except, possibly, for a boosting charge during the dinner hour. The earlier types of trucks were inclined to be weak in the frame, but subsequent experience has largely rectified this.

In order to get full service out of such trucks, as well as the labour employed in operating them, it is not unusual to provide portable platforms or stillages on to which the goods can be loaded prior to transport. The carrying capacity of electric battery trucks of stock design runs up to two tons, and their speeds, loaded on suitable surfaces, reach as much as seven m.p.h. Their use need not be confined to the quay and road levels, as they may with advantage be employed on the upper floors of warehouses when the areas of the floors warrant it.

There is a number of different classes of cranes which come under the heading of portable electric warehouse cranes. Generally speaking, self-travelling warehouse cranes do not give the best service if used for transporting purposes, and it is much more economical to use electric warehouse trucks to perform this service. As regards lifting capacity, this is seldom required to exceed 15 cwt.; in fact, when this figure is exceeded the weight of the crane becomes rather a serious item. As the total height of lift is comparatively small, high speeds are not required. It is advisable to see that, not only is the jib capable of being lowered so as to pass through the warehouse doors, but that the fixed superstructure of the crane is not so high that it will not pass through as well. The crane should also be capable of turning round in the least possible radius so that, in passing along aisles and trucking ways, suitable clearance is obtained without having to reduce the storage capacity of the floor.

The Faraday Society.

The Brittleness of Zinc-plated Steel.

MR. H. SUTTON read a paper on this subject on April 27th. The matter is of some importance from the engineering standpoint, for a very thin coating of zinc on iron or steel forms an excellent protection against corrosion, on account of the more electro-positive character of the zinc, and electro-deposition is the best method of obtaining such a thin coating where it is desirable to apply it without heating the metal. Now hardened steel, such as springs and the streamline wires of aeroplanes, often needs such a protective coating of zinc, but it has been found that the process of deposition has made the spring or wire very brittle. The same embrittling effect is known to be produced by pickling steel in dilute sulphuric acid, and the cause no doubt is the same, being due to occluded or adsorbed hydrogen, which would be deposited on the cathode with the zinc. The purpose of Mr. Sutton's experiments was to find a means of avoiding or removing this brittleness.

All the experiments were made with streamline wires made of medium-carbon steel, and brittleness was measured by bending tests. An unplated wire would stand 6 to 7 and a plated wire from about 2 to 4 reversals.

The purpose of the first series of experiments was to find whether varying the conditions of deposition would prevent embrittling. Both cyanide and sulphate solutions were tried at various temperatures and current densities, and the influence of colloidal addition agents was tested, but while the embrittling was under some conditions diminished, it could not be eliminated, although plating in a neutral sulphate bath produced very little embrittling effect. Such a bath, however, is not otherwise satisfactory. In the second series of experiments attempts were made to remove embrittlement after the deposition of the zinc. Generally, plated wires would recover their ductility in standing, even at ordinary temperatures, if sufficient time were allowed. The recovery was greatly accelerated at higher temperatures, and the brittleness of wires carrying deposits of 0.0005 in. thickness was almost entirely removed by immersing the wires in boiling water for 30 minutes or by heating to 100 deg. in air for the same length of time. The nature of the surface of the wire had a marked influence on the recovery; the rougher the surface the less completely did it recover. Such a surface would be expected to facilitate absorption of hydrogen. Harder wires were found to be embrittled more than softer ones.

While it seems fairly well established that the embrittling is caused by hydrogen, it is a little curious that it can be removed, or, at least, its effect eliminated, at so low a temperature as 100 deg. C.

Adhesion of Deposited Nickel to the Base Metal.

This was the subject of a useful paper by Mr. E. A. OLLARD. The adhesion of a deposited metal to its base is of great practical importance. Machine parts are now built up or repaired with electrodeposits of nickel, iron, or other metal, and the work is useless if there is any possibility of the deposit stripping. Nickel is particularly prone to separate from its base unless great care be taken in the conditions of deposition. The matter is also of theoretical interest, as bearing on the theory that adhesion between two metals is dependent upon inter-penetration and alloying.

The present experiments were made by depositing a large knob of nickel on one end of an inch steel rod, two inches long. The rod was hung horizontally in the nickel bath, and deposition proceeded for 250 hours. All the nickel deposited over the edge was then turned off in a lathe, leaving an end of nickel overhanging by about ¼ in. Adhesion was tested by pulling the deposit straight off the rod in a tensile machine. The novel feature of the work was the care with which a satisfactory adhesion test was devised.

The factors governing adhesion are the chemical and physical condition of the surface of the base metal and the conditions under which the first layer of the deposit is made. Freedom from dirt or grease is, of course, an elementary precaution, but it was also found essential to expose the crystals of the steel, and anodic pickling in a 30 per cent. sulphuric acid solution was found to be the best method of effecting this. The "striking current" most favourable to adhesion was passed in a bath containing 3 lb. nickel sulphate, 6 oz. magnesium sulphate, and 4 oz. boric acid per gallon, and a temperature of 25 deg. C. or more was found to be necessary. For good adhesion the voltage and current density had to be kept low, differing in this respect from what obtains in most plating processes. The author ascribes the efficacy of the anodic pickling process to the formation of a layer of adsorbed oxygen, which renders the steel passive and protects it while being transferred to the plating bath. When the deposition is started the adsorbed oxygen is removed by the hydrogen immediately precipitated, and so the nickel can readily be deposited straight on to the steel. Long ago Huntington observed that if an electrodeposit is made on a carefully pickled metal its structure may follow that of the base. Microscopic examination favours the suggestion that adhesion is due to cohesion between the crystals of the two metals and not to the keying action of the nickel into the pickled base, but further experimental work must decide whether the cohesion is due to molecular attraction, intermingling of the space lattices, or an inter-crystalline cement.

Statistical Data on Shop-Lighting.

A Survey of the Illumination in 800 Retail Shops.

THE survey of lighting in 800 retail shops, summarised by Mr. W. J. Jones and Mr. H. Lingard at a recent meeting of the Illuminating Engineering Society, at the E.L.M.A. Lighting Service Bureau, Mr. C. W. Sully presiding, was an enterprising effort which must have involved a considerable amount of work. It is doubtless true, as was pointed out in the discussion, that such a survey inevitably only takes account of a very few out of the total number of shops in this country; hence, one should not be too ready to draw unfavourable conclusions regarding any particular class. Nevertheless, the results suffice to show the need for educational work amongst retailers. Leading stores are naturally in a different class altogether. In most cases the lighting is incomparably better than it used to be, and there is little ground for complaint, but the problem of reaching the great mass of small shops is a difficult one. Seeing that the great majority of them use gasfilled lamps of relatively big size, it may be conjectured that the advantages of using efficient units have been brought before their notice with fair success. Unfortunately such lamps are frequently unwisely used; hence the prevalence of glare which, as the authors remarked, is so common in the shop-window that it is not instinctively felt to be out of place in the home, office, or workshop. In other words, badly lighted shop windows have a most prejudicial educational effect on the community. The Illuminating Engineering Society has done well to provide an opportunity for the presentation of these data—we believe the first of their kind to be collected in this country. One of the most promising means of bringing about an improvement seems to be to approach the various retailers' organisations, where they exist. It is "up to" all those associated with the electric lighting industry to take a hint from this discussion and use their influence to eliminate the misuse of light.

The 800 retail shops examined were distributed amongst nine different towns and collected data secured by the circulation of a series of questions, were analysed with the aid of a variety of diagrams. The results brought out many interesting conclusions: It was shown that the 100-watt lamp was much the most popular size, 52.5 per cent. being of this type. It was also somewhat surprising to find how generally the gasfilled lamp has come into use, 81.5 per cent. being used for windows and 78 per cent. for interiors. The use of these powerful lamps naturally makes the need for proper glassware in order to reduce glare specially desirable. As regards intensity of illumination in windows, only 6.5 per cent. of the shops surveyed were considered "excellent," 11 per cent. were classed as good, 21.5 per cent. as fair, and 61 as poor. There is therefore as much need for improvement in this respect, as in the avoidance of glare.

Of shop-interiors 43 per cent. only had local lamps over the counter. There is an increased tendency to make extensive displays of goods in the interior, which necessitates a high standard of illumination in all parts of the shop; hence pendant special lamps over the counter tend to fall into disuse. The degree of illumination in interiors varied within wide limits: 11 per cent. had 10 foot-candles and over, 51 per cent. 5-10 ft.-c., and 38 per cent. 5 ft.-c. or under. In general, about 5 foot-candles may be expected for every watt used per sq. ft. Only 5.2 per cent. of shops used totally enclosed units (notwithstanding the fact that depreciation due to dust is much less with this form of lighting than with open types of bowls). Most shops (41 per cent.) used diffusing shades and prismatic reflectors, but as many as 36 per cent. used bare lamps, clear glass shades, conical opal shades, &c., all presumably unsatisfactory.

Very interesting, if somewhat debatable data, were given for different trades: Tailors seem to stand out well; 93 per cent. of this class of shop make use of display window dressing, which is more compatible with good lighting, and in common with bootshops and drapers, these shops mainly used general lighting (*i.e.*, without special light over counters). Tailors also show the largest percentage (25.6 per cent.) with 10 foot-candles and over. Tobacconists show an abnormally high proportion of shops (76 per cent.) classed as poorly lighted, and apparently butchers, confectioners, and provision merchants are nearly as bad. Much doubtless depends on the nature of the window display. The close dressing against the window commonly adopted by jewellers and tobacconists is doubtless associated with the use of bare lamps, though apparently provision shops (with 55 per cent. using bare lamps), are the worst sinners in this respect.

There was a good discussion in which seventeen speakers took part. It was generally agreed that the series of data was most instructive, and furnished a clear indication of the need for educational work amongst retail shops.

After the reading of the paper an opportunity was provided of examining a comprehensive exhibit of shop-lighting appliances assembled by leading manufacturers, and in the adjacent demonstration room a display of colour-lighting and an effective demonstration of methods of lighting advertisement placards were to be seen.

Extensions at Stoke Newington.

ON Thursday last week the official inauguration of the additional motor converting plant, and the opening of the new showroom and offices of the Stoke Newington Borough Council's Electricity Department, took place. The occasion was designed to mark an important step in the progress of the undertaking which has 2,350 consumers, to whom it distributes the supply received from the North Metropolitan Electric Power Company.

The ceremony of starting up the two 1 000-kW Bruce Peebles motor converters (fig. 1) was performed by the Mayor (Councillor Miss C. Maude Eve), and the company present then adjourned to the adjoining Library Hall to listen to a number of speeches, some of which were interesting electrically and others purely locally. The new showroom, which we illustrate in fig. 2, is in Edwards Lane, Church Street, and forms part of a long frontage, including the electricity works, the Library Hall, &c.

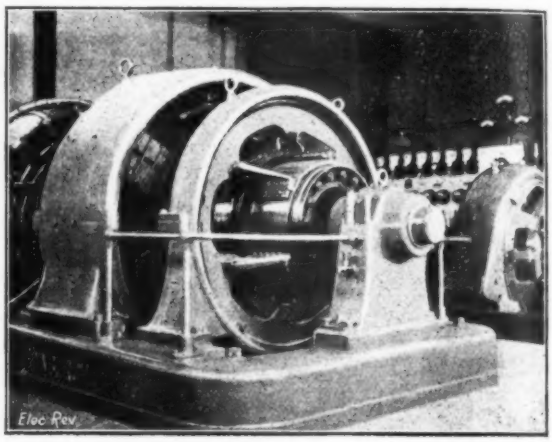

Fig. 1.—New Bruce-Peebles Motor-Converters at Stoke Newington.

After the Town Clerk had given some particulars of the early history of electricity supply negotiations in the borough, the chairman of the Electricity Committee (Councillor J. Spetch Wilson) referred to the more recent course of events, the progress of the undertaking, and the latest plant extension and the contractors responsible therefor. Good words, and well deserved, were said regarding Mr. Hann, the borough electrical engineer, and his staff, who we hope, under the new

Fig. 2.—The Stoke Newington Showrooms.

régime to which the chairman referred, will have the satisfaction of seeing a progressive commercial spirit rewarded with the support of a public whose electrical interest needs a stimulus. Captain Donaldson, chief engineer of the North Metropolitan Electric Power Supply Co., delivered a brief speech on the difficult problem of electricity supply in London, the way in which it had developed, the opening of its very early stations, the coming of a Joint Electricity Authority, and on what might happen in the future. Some interesting reminiscences were given by Mr. W. H. Savery, a former chairman of the Committee, after which the

Mayor formally declared the extensions, showrooms and offices open. Her services were acknowledged in appropriate terms by Councillor Starbuck, who mentioned the fact that the electrical plant had until that day been sacred to man; it had fallen to the first lady Mayor to give the undertaking a new and promising send-off.

It was stated by the chairman that the cost of the new extension, including buildings, converters, switchgear, and mains, had been £32,000; also that the undertaking had never cost the ratepayers a penny, nor would it do so.

There were demonstrations of electrical appliances during the afternoon and evening and a programme of electrical addresses had been arranged, but we are not sure that the latter were quite successful so far as public interest was concerned—perhaps it was the wrong time of year.

The following were the contractors for the new work:—Bruce Peebles & Co., Ltd. (motor converters); General Electric Co., Ltd. (switchgear); W. T. Henley's Telegraph Works Co., Ltd. (feeder and distributor cables); L. & W. Whitehead, Ltd. (buildings); Mr. J. H. Golding (electrical installation work); and S. Goodall & Son (machinery foundations).

The exhibitors included:—The Aeolian Co., Ltd. ("Duo-Art" pianola piano); Bastian & Allen (Bastian storage geysers); Baxter & Caunter, Ltd. (cookers, irons, and wash boiler); Belling & Co. (fires and ovenette); Berry's Electric, Ltd. (Magicoal fires); British Electric Transformer Co., Ltd. (cookers); British Thomson-Houston Co., Ltd. (fittings, standards, &c.); General Electric Co., Ltd. (irons, fires and toasters); W. T. Henley's Telegraph Works Co., Ltd. (surface wiring system); Hotpoint Electric Appliance Co., Ltd. (cookers and vacuum cleaner); Metro-Vick Supplies, Ltd. (vacuum cleaner, roaster, boiling table); G. Nobbs, Ltd. (wash boiler); Sullivan & Co., Ltd. (fires); Sun Electrical Co., Ltd. (A.B.C. washer); J. H. Tucker & Co., Ltd. (switches and plugs); and X-Rays, Ltd. (dental outfit).

An Automatic Electric Burglar Alarm.

We recently witnessed a demonstration of the "Defiance" automatic burglar alarm which is being put on the market by the makers, MESSRS. JOHN HEARSON & CO., LTD. This ingenious device, by virtue of a double control to which it is subjected, is claimed to be fool-proof. A modified diagram of installation connections accompanies this article (fig. 1); only one alarm is shown, but of course any number may be connected in series.

The alarm L, which takes the form of an electric bell, is operated under the influence of a local battery L B, which is entirely independent and separate from the main battery M B controlling the devices for the protection of doors, windows, safe, &c., and is controlled by a main relay A, and a displacement coil D. The connecting devices X, for protection against

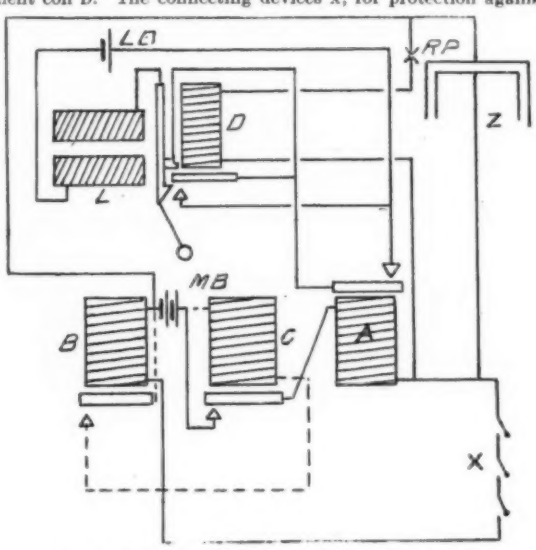

Fig. 1.—Modified Diagram of a "Defiance" Installation.

the opening or closing of doors and windows, are arranged in series with the main battery, main relay coil, the armature of a second relay C, and the coil of a third relay B, forming the main or contact circuit which is continuously closed, when the alarm is set, in normal times. Any break in this circuit results in de-energising the main relay and consequently, by the displacement of the main relay armature, in putting the local battery in circuit with the alarm. The first attraction of the alarm armature displaces the armature of the displacement coil, which completes the local circuit, and the alarm continues to operate until reset.

Door panels, &c., are each protected by means of two tin-foil sheets Z, which are separated and interlaced in the wood. These sheets are arranged one on each pole of the main battery so that any attempt to bore through the wood will establish contact between the plates, thereby closing a circuit which short-circuits the connecting devices X and the coil of the relay B. This coil will therefore be de-energised, with the result that the armature of relay B will close the dotted branch circuit through the coil of relay C. Relay C will become energised, with the result that its armature will break the main circuit, and thus de-energise the main relay and operate the alarm. Window panes are protected by the usual "hinged inside window," arranged so that pressure from the outside or inside disconnects or "shorts" the circuit as the case may be. The safe, alarm, batteries, relays, and any article in the protected premises so desired, may each be protected by means of a wooden casing completely covering the article, tin-foil sheets being interlaced in the wood and connected in circuit as in the case of the door panels.

The setting of the alarm is effected by closing the replacement push R P; this energises coil D, attracts its armature and breaks the local circuit. Both the alarm and displacement coil armatures engage by means of a detent on the former and the local circuit is held open until it is reclosed under the influence of the main relay. The setting of the protection circuits is effected by the operation of sliding contacts brought about by the closing of the main door, after all the connecting devices have been put in circuit. The branch circuit through the coil of relay C is first closed, then the main circuit through the coils of relays A and B is closed, the branch circuit being again broken by the operation of the armature of the relay P. The final operation of this armature makes a momentary connection in an outside circuit which gives a visible indication that the circuits are set.

We understand that arrangements have been made with the G.P.O. and police authorities which will permit of any "Defiance" installation being connected to the telephone system, if so desired, so that the alarm may be given direct to the police.

The makers are also prepared to install a thermostat apparatus in connection with any "Defiance" alarm installation, to operate the alarm in the case of fire.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Trade with Brazil.

As I have had to visit Brazil several times to examine and report upon water power projects, some of which have been carried out, as well as to investigate the cost of power, and have travelled a good deal over the Southern States of Brazil, and northwards as far as Rio de Janeiro, Minas Geraes, a few words of mine may be worth printing.

The Southern States, such as Rio Grande do Sul, were before the war overrun with German settlers; they were to be found everywhere in the towns, on country farms, &c. The talk then was that at a favourable opportunity they would break away from Brazil and ultimately join up as one of the Colonies of Germany. There was, as far as I know, still no railway communication with Rio de Janeiro; it was, one might say, isolated from the Central Government. The only railway of importance ran to Uruguay. The whole of this part of Brazil is good agricultural land and good cattle are raised. Water power easy of development is found in several places near Puerto Alegre and some in particular is well worth development.

In the Santos and San Paulo districts the foreign element is mainly British; it used to be French.

Much good water power around San Paulo has already been developed, but much more remains to be used and the demand for power is growing rapidly.

In Rio de Janeiro the principal foreign influence I should say is undoubtedly French. Almost unlimited power is required; as everyone knows, big hydraulic developments have already been made, but there are within 100 miles of Rio several good hydraulic propositions that could be developed. The Pearson group controls the electricity supply to Rio de Janeiro, also the tramways, so that so far American plant, &c., has been provided.

As far as the country further North is concerned, I am not in a position to speak from my own investigations, but I have carried out surveys and studies for various hydraulic power schemes in the States above-mentioned, and therefore what I have written is not hearsay. The railways in Rio de Janeiro alone will require an enormous amount of power, and it must be hydraulic to pay, and should be hydraulic as the water power is there to be developed. If some large group of London financiers were to get together and form a syndicate to go to the Brazilian Government and lay before it a big but considered scheme for developing some of these powers, such a group would, I believe, obtain the ready assistance of the Government. But then, of course, they would be encroaching

on the Pearson Group's sphere of influence; in any case, the Pearson Group (Canadians), has not been any help to the home industries. The staff and materials are all, or nearly all, from the States.

There are so many ways that can be used to promote trade with South American countries if a certain amount of vision is brought to bear upon the subject, of course together with financial backing.

J. E. Stewart.

Swansea, *May 23rd*, 1925.

Heating Water.

With reference to Mr. Hope's article on "Heating Water by Electricity" in your issue of the 22nd ult., may it be suggested that to the superficial reader (and many of us have not time to be more), his conclusion may be misleading? He has compared a modern electric storage system with a very out-of-date coal-heated type. Had he experimented with his 4,000-gallon tank, the contents of which was heated by means of a small coal or anthracite furnace, I venture to suggest that the results would have been even more satisfactory.

My remarks are based on the remarkable results which can be obtained in an ordinary house where a small separate boiler is used for water heating and the main reserve tank and all pipes are well lagged. By emptying the kitchen fire into this boiler in the evening and adding ashes or any rubbish, a supply of hot water for the next day is assured.

J. E. Gilbert.

Birmingham, *May 30th*, 1925.

Technical Journals for Boys.

Circulation of technical journals amongst the rising generation is all-important, but the subscriber must be caught young. I was caught by the gift of old journals from my first employer, and would suggest that many old members of the electrical profession would gladly assist young learners by the gift of the journal which, through failing eyesight, is little read by the elder man, although he still delights in glancing through it to see "what is doing" electrically.

If, with your aid, some system of "adoption" could be established, I would certainly have pleasure in re-addressing my electrical journals to an "adopted" apprentice, just as we used to send tobacco and cakes to the boys during the war.

E. C. B.

May 31st, 1925.

Wiring Systems and Wireless Telephony.

With reference to the letter in last week's issue of your REVIEW, I quite agree with Mr. P. Dunsheath, as I have had the same trouble; the broadcast reception is marred by a humming noise in the head-'phones, due to induction from the wiring. But when I switch off the main switch all is well. A way out of the difficulty would be for architects to use metal-covered house wiring systems.

John Braby,
Chartered Electrical Engineer.

Woking, *June 1st*, 1925.

Insurance of Generating Plant.

We have been consulted by the Vulcan Boiler and General Insurance Co., Ltd., with reference to the report which appeared in the issue of the ELECTRICAL REVIEW of the 22nd instant, headed "The Insurance of Generating Plant," and announcing the result of the arbitration between our clients and the Keighley Corporation. The report omits to state two very essential facts, *viz.*: (1) that after the renewal notice was sent by our clients to the Corporation, the Corporation's electrical engineer wrote to our clients and informed them that the Corporation were obtaining fresh quotations, and (2) the arbitrator found as a fact that at the time of the breakdown of the Corporation's electrical plant there was no intention on the part of the Corporation to renew the policies under which the claim was made.

We shall be glad if you will in the next issue of the ELECTRICAL REVIEW insert a paragraph setting out the above facts, as the report, as it stands, is damaging to our clients and conveys a false impression.

Cobbett, Wheeler & Cobbett.

Manchester, *May 27th*, 1925.

[We have pleasure in giving publicity to the above letter. Our summary of the matter was based on a report presented to the Keighley Town Council and the statements made in connection therewith. These, our representative informs us, contained no reference to the points mentioned by our correspondents.—EDS. ELEC. REV.]

Baldwin's Telephone History.

Mr. Baldwin seeks to ride off by asserting that the figures in his Table 12 are accurate. So they are in themselves, but my complaint is that they represent only a part of what he ought to have given. They are but one of several items going to make up the aggregate number of stations, and he causes them to masquerade for the total.

If Mr. Baldwin received only 8s. 6d. change for a £1 note he would probably object and decline to be consoled by the assurance that the coins offered were quite genuine. That is my case. I don't want genuine figures that misrepresent.

The unfairness is emphasised by the manner in which he treats the Post Office in his Table 15. There, in stating telephonic progress in London, he is careful to give columns for both direct lines and total stations. Had he not done so, Post Office progress would have been greatly understated. Why should Guernsey be differently treated?

But error dogs his footsteps. In this same Table 12 he makes two other mistakes. He heads it as Statistics from 1898 to 1921, and yet gives columns for 1922 and 1923. In the years 1898 and 1899 small losses were incurred, and so I advised him, yet Mr. Baldwin prints them as profits.

Far be it from me to be hard on a new author, but is it right that I should be fathered with all this inaccuracy?

E. H. Bennett,
Manager,
STATES TELEPHONE DEPARTMENT.

Guernsey, *May 27th*, 1925.

Luminous Electric Radiators.

There is one statement in Mr. Dowsing's letter in your current issue which I think ought to be corrected. He suggests that electric lamp radiators are valuable as a form of sunshine treatment. It has, however, been shown by Dr. Hill that the beneficial effects of sunshine treatment are due to the action of ultraviolet light, and it is well known that these rays are cut off by all ordinary glass, and that the new glass which permits them to pass is not yet beyond the experimental stage.

For this reason, artificial sunshine is at present produced by lamps having quartz bulbs or by naked arc lamps, and it is misleading to suggest that the same effect will be produced by lamp radiators.

Wm. Cramp.

The University, Birmingham,
May 29th, 1925.

[In this connection, the article by Mr. J. W. Ryde which appears elsewhere in this issue will be found particularly interesting and informative.—EDS. ELEC. REV.]

The question under discussion according to your footnote *is* the relative efficiency *as radiators* of the two types of electric heaters.

For many years past I have sold at least three times as many lamp-type radiators as non-luminous ones. In my own house, I use (not as ornaments) lamp-type radiators only, because from experience in everyday use I find them much more pleasant than a fireclay bar and wire-type fire. In one of my customers' houses I have installed 13 kW of lamp radiators, after both types had been tried.

Now you *can* sit in comfort with a 4-lamp radiator in front of you, but can anyone find comfort in sitting in front of 1 kW of fireclay and wire? The reason one cannot, is because the radiant heat is so considerably less.

I always understood it was agreed that a radiator (*sic*) of the fireclay and wire type would give about a third radiant heat and two-thirds convected heat. If personal comfort goes for anything, I should say this was about true, and that for a lamp-type radiator the figures should be reversed.

C. Culmer Hodges, A.M.I.Mech.E.

Electricity Works,
Dawlish.

[Mr. Hodges's experience is in direct conflict with our own, and with the results of actual measurement. We do not know what types of "fireclay and wire" radiators he has tried, but we can vouch for the comfort we derive from the radiation of a 600-W bowl fire at 10 or 12 feet distance, which cannot be due to convection.—EDS. ELEC. REV.]

The Lighting of Railways.—In his lecture on railway lighting on May 25th, the last but one of the series of lectures on "Illuminating Engineering," that are being delivered at the Polytechnic, Mr. A. Cunnington showed how varied a series of problems confronts the railway engineer. He dealt in succession with all the chief points that arise in a large terminus. The need for the effective lighting of approaches, and of the "concours" where passengers assemble to wait for admission to platforms, was emphasised, and he expressed a hope that future schemes of electrification would be accompanied by better lighting, relieving the gloom that characterises many of our leading termini at present. Whilst dwelling mainly on the need for good lighting as a measure of safety, Mr. Cunnington was able to show many examples of the way in which it is now being applied for the convenience of passengers. Such matters as the provision of illuminated direction-signs and station name-plates are now being considered; the only wonder is that the importance of these questions was not realised long ago. A very interesting diagram showed how, by the proper allocation of illuminated name-plates, it could be ensured that a passenger could not fail to recognise his destination, and after the lecture various recent designs of such apparatus were shown.

Recent Radio-Telegraphic Research.

The National Physical Laboratory's Work.

THE annual report of the National Physical Laboratory,* which was abstracted in our April 24th issue, contains an interesting account of the radio-telegraphic and telephonic research work carried out in the Wireless Division of the Electricity Department of the Laboratory.

For instance, in collaboration with the Photometary Division, a preliminary report on life tests of thermionic valves has been presented to the Valve Committee of the Radio Research Board. Experiments have been carried out to investigate the life of the valves operated at various voltages as lamps, as oscillation generators, and when emitting electrons with various power dissipations at the anode.

The results have shown that with anode dissipations of less than 20 watts for the (V.T. 1.A. 30 watts) type of valve tested, the life is a function of the filament voltage alone. The life appears to vary as the inverse twelfth power of the voltage, if it is maintained constant throughout life. It was further deduced that the life at constant current varied as the inverse twentieth power of the current. Experiments have been carried out on the relation between the temperature and voltage of the filament, and a correlation of the lives and filament temperatures obtained, which has been compared with existing data. No great accuracy is claimed for the results on filament temperatures owing to the pronounced dark coloration of the

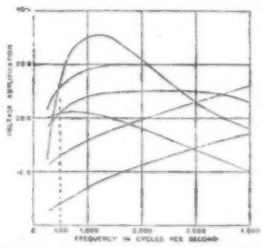

Fig. 1.—Result of Low-frequency Transformer Tests.

bulbs, but efforts to correct for these effects have been made. It appears not unlikely that the work so far carried out shows that, within reasonable limits, it will be found practicable to apply "forced life tests" to valves of this character.

The analysis of the observations of apparent bearings of fixed radio transmitting stations carried out for the Radio Research Board in conjunction with various British universities is nearing completion. The detailed account of this investigation is being published in the form of special reports by the Radio Research Board. The first report published † deals with some 41,000 readings taken on damped-wave transmission over a range of wave-lengths from 2 to 9 km. The second report will deal with some 155,000 further observations, the bulk of which were made on undamped-wave transmission over the same range of wave-lengths. In 1922 the general investigation was extended to much shorter wave-lengths from 2 kilometres down to 450 metres, the latter being the wave-length in general commercial use for direction-finding in this country at present, and the detailed analysis of the results has been commenced. A study of direction-finding conditions with the propagation entirely over sea was described in a recent paper by Mr. R. L. Smith-Rose ("Some Radio Direction-Finding Observations on Ship and Shore Transmitting Stations," *Journal* I.E.E., 1924, Vol. 62, pp. 701-711). The general conclusion is that, when the path of transmission of the waves is entirely over sea and in a direction making an appreciable angle with the coast line, so as to be free from coastal refraction effects, the accuracy of radio direction-finding is sufficient for most navigation purposes up to ranges approaching 100 miles. At greater distances over sea the variable errors encountered, chiefly at night, result in a considerably reduced accuracy in the observed bearings. When the path of transmission is entirely over land the variable night errors are encountered at shorter distances, down to a minimum of about 30 miles.

For the explanation of the variable errors encountered, chiefly at night, on radio direction-finders, modern theory implies the reception of waves arriving at an appreciable angle of elevation and polarised so that the magnetic field has a horizontal component in the plane of propagation. Such abnormally polarised waves can be radiated from certain kinds of aerials when situated at a considerable distance from the earth's surface, as in the case of an aeroplane transmitter, and such waves, when arriving at the earth's surface, can produce very appreciable errors on a radio direction-finder. Experiments have shown (R. L. Smith-Rose, "The Effect of the Shape of the Transmitting Aerial upon Observed Bearings on a Radio Direction-Finder," *Journal* I.E.E., 1924, Vol. 62, pp. 957-963), that the frequency and magnitude of these errors are independent of the shape of the transmitting aerial, within the limits of the investigation, and the use of a source of radiation which is, as far as possible, only polarised in the normal manner in no way diminishes the night effects generally experienced.

Regarding the measurement of signal strength, regular observation on long waves is now possible on a signal consisting of only a few 20-second dashes and the four receiving sets are being fitted with a new type of galvanometer which will enable readings to be taken on any routine transmission except possibly high-speed automatic. A large number of results have been obtained which show some interesting and quite unexpected effects, but the tests have not yet continued long enough for anything but provisional summaries to be made.

For the measurement of harmonics of high-power long-wave transmitting station apparatus has been developed and figures were obtained for one station down to the 14th harmonic. It was decided that the problem was not of sufficient importance to justify the production of apparatus for the measurement of harmonics at a distance from the aerial, as the more modern stations are comparatively free from this form of trouble owing to the better knowledge of design now obtained.

The development of a suitable method for the determination of voltage amplification under actual working conditions either of a series of high or audio-frequency stages, or a mixed combination of both with a rectifier, has produced finally a reliable method which has been tested for practical cases. The method cannot be considered final, but it has been demonstrated that, within specified limits, statisfactory determinations of voltage aplification under actual working conditions can be obtained. The method consists essentially of measuring both the voltage input to the amplifier at radio or audio frequency and the audio oscillatory current in the output circuit. Much important information has been obtained, both as regards the reliability and accuracy of the method, and also regarding the general behaviour of simple types of amplifier. The multiplication of stage voltage amplification has been found to be possible in both high- and low-frequency cases if great care is taken in the design. This research has been performed with the object of specifying more definitely the conditions under which amplifier tests are to be made, and at the same time to postulate the factors which determine signal intensity. Although the amplification tests so far made apply chiefly to receiving apparatus used for Morse reception, the results give much useful information regarding the testing of telephone receiving systems.

At the request of the Radio Research Board measurements were carried out for the determination of the equivalent decre-

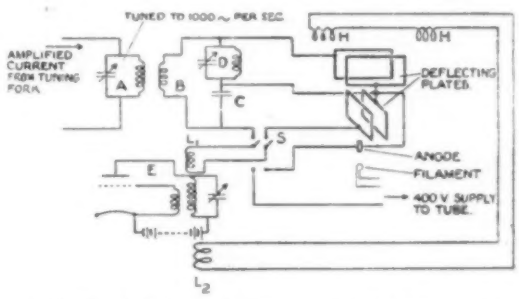

Fig. 2.—Cathode-ray Measurement of Radio-frequency and Wave-form Delineation.

ment of radio-telephone transmissions, based on the definition of equivalent decrement contained in Section LXXXII of the Regulations of the International Radio Telegraph Convention, and the Board has agreed that the present definition of equivalent decrement is not satisfactory as a means of specifying the interfering capacity of radio telephonic transmission and has recommended that investigations should be made with a view to obtaining a more satisfactory criterion.

In connection with the development of methods for testing broadcast receiving sets experiments were carried out with a view to determining the most efficient aerial and earth systems for the reception of short-wave transmission in the broadcast range. It was found that the insulated earth screen, consisting of four wires about 10 ft. apart, was greatly superior to the buried plate or water main earth connection, giving about twice as large a received current and about half of the aerial resistance. It was also found that earthing the screen destroyed its superiority unless the earth lead was separately tuned, in which case a slight increase of received current over that given by the insulated screen could be obtained.

Keeping the earthing system fixed (in the form of an eleven-wire screen) measurements were carried out on a variety of aerial forms, and the conclusion reached was that a two-wire

* H.M. Stationery Office. Price 8s. 6d. net.

† R. L. Smith-Rose: "Variations of Apparent Bearings of Radio Transmitting Stations."—Radio Research Board, Special Report No. 2, 1924. H.M. Stationery Office.

aerial with the wires about 8 ft. apart, the aerial being about 30 ft. high and 70 ft. long, was a very satisfactory arrangement from both the electrical and the practical point of view.

During the year 1924 some 46 transformers of different manufacture and design were submitted for test and their widely varying behaviour is illustrated in fig. 1, which shows the variation of voltage amplification with frequency of six transformers typical of those tested. Seven thermionic valves were submitted for the measurement of their static characteristics and certain tests have been made on aerials and tuning inductances to be used therewith, chiefly in connection with broadcast reception.

The results which have been obtained on intervalve transformers sent to the Laboratory for test showed that the factors operating were somewhat complicated. A number of experiments were therefore made with a view to analysing the various inductances and capacities operating in the transformer. The results show that a complete explanation of the behaviour of these transformers has been obtained and the method of analysis developed is now incorporated in the routine series of tests which the Laboratory is prepared to undertake on such transformers.

A cathode-ray tube has been used in a novel manner for measuring low radio frequencies and for showing the wave form at such frequencies. Amplified current from a tuning fork is obtained in the tuned circuit A (fig. 2) in the anode circuit of a two-stage amplifier. The inductance has an air core and is coupled to a coil B which supplies two-phase voltage by means of a condenser C and virtual non-inductive resistance formed by the tuned cell D (the object of using the latter instead of an actual non-inductive resistance being to provide a path of low impedance at frequencies other than that of the tuning fork, in order that parasitic voltage from the radio-frequency source R may not operate in this circuit). The two quadrative components of voltage are applied to the deflecting plates of the tube. In the circuit of the plates connected to C is a break at S so that the radio-frequency may be introduced into this circuit when so desired. Voltage from the radio-frequency source R is obtained by coil L, for application either to one pair of deflecting plates *via* switch S (when up) or in series with the main anode supply to the tube when S is down.

In addition to L_1 another coil L_2 coupled to E supplies a small current to a pair of flat circular coils H wound on a double ebonite bobbin mounted on the lower parallel portion of the cathode-ray tube. The bobbin can be slewed round so as to enable the deflecting radio-frequency magnetic field to be altered in direction relatively to the deflections produced by the plates. By these arrangements the cathode ray may be caused to describe a circular or elliptical path at the frequency of the tuning fork; at the same time it may be given a small circular, elliptical, or straight-line motion at the radio frequency. The straight-line motion can be produced as motion in a constant direction when the radio voltage is applied to the deflecting plates—or it may be produced as a radial motion when the radio voltage is applied in series with the anode voltage supply to the tube. If the radio-frequency is an integral multiple of the tuning fork frequency then, when both motions are simultaneously applied to the ray, a stationary symmetrical pattern is produced depending upon the kind of displacements acting. Fractional radio frequencies, such as 24,500 or 30,333, can be produced accurately by this method as well as straight integral multiples of 1,000, and the method should have useful applications in connection with distortion of amplifiers and the examination of low radio or high audio wave forms generally, in addition to its use as a radio-frequency standard.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

27,439. "Wireless aerial circuits." J. Scott-Taggart. November 1st, 1923. (232,659.)

28,280. "Electrical thawing of carcases of frozen meat and the like." A. U. Alcock. November 9th, 1923. (Cognate application 7,961/24.) (233,373.)

28,491. "Manufacture of filaments for electric lamps, thermionic tubes, and the like." W. R. Bullimore. November 12th, 1923. (233,374.)

28,492. "Manufacture of filaments of cathodes for electric lamps, thermionic tubes, and the like." W. R. Bullimore. November 12th, 1923. (Cognate application 28,484/23.) (233,375.)

1924.

104. "Electric heaters and lighting apparatus for heating and warming and lighting apartments, the airing of bedding and such like, and the preservation of billiard tables and musical instruments." B. Jones. August 28th, 1924. (229,363.)

936. "Amplifying, detecting, and wave generating apparatus for use in wireless signalling." E. M. Eadie. January 11th, 1924. (233,390.)

2,702. "Electrical marine propulsion." A. H. Railing and M. L. Kahn. February 2nd, 1924. (233,397.)

2,817. "Fittings for electric lights." W. Harrison and E. Eyre. February 4th, 1924. (233,399.)

2,880. "Telephone receivers." Fuller's United Electric Works, Ltd., and A. P. Welch. February 4th, 1924. (233,403.)

3,023. "Electric type wheel actions for typewriting machines." E. C. R. Marks (Scheiblus & Ritter). February 5th, 1924. (233,407.)

3,068. "Electric switches." F. B. Cox. February 6th, 1924. (Patent of addition not granted.) (233,411.)

3,101. "Two-way transmission systems with repeaters, particularly for telephone lines." Western Electric Co., Ltd. February 7th, 1923. (211,135.)

3,129. "Aerial receiving systems for wireless signalling." T. G. Threlkeld and A. W. W. Butterfield. February 6th, 1924. (233,416.)

3,130. "Radio-receiving apparatus." P. W. Willans. February 6th, 1924. (233,417.)

3,138. "Electrical apparatus for medical and like purposes." F. Magrini. February 6th, 1924. (233,418.)

3,220. "Electric heating installations for railway vehicles." Stone & Co., Ltd., and A. H. Darker. February 7th, 1924. (233,421.)

3,223. "Thermionic apparatus." F. Holweck. February 7th, 1923. (Addition to 206,155.) (211,143.)

3,345. "Means for testing electric circuits." W. Firkey. February 8th, 1924. (233,431.)

3,422. "Electric rheostats, switches, and the like." J. H. Bradley. February 9th, 1924. (233,434.)

3,436. "Electrical contact devices for telegraph transmitters and other purposes." J. H. Dunbar and Eastern Telegraph Co., Ltd. February 9th, 1924. (233,435.)

3,481. "Refill batteries." M. Zeiler. February 11th, 1924. (233,437.)

3,488. "Two-way transmission systems with repeaters, particularly for telephone lines." Western Electric Co., Ltd. August 3rd, 1923. (Addition to 211,135.) (219,927.)

3,511. "Control of electrically-operated switches." British Thomson-Houston Co., Ltd., and H. C. Hastings. February 11th, 1924. (233,438.)

3,639. "Liquid heaters." British Thomson-Houston Co., Ltd. (General Electric Co.). February 12th, 1924. (233,440.)

3,689. "Telephones." F. T. Maley and E. A. Doddy. February 12th, 1924. (233,443.)

3,907. "Earthing switch for wireless aerials." A. G. London. February 15th, 1924. (233,447.)

4,163. "Luminous electric signs." F. H. Eeles and H. M. Duchard. February 18th, 1924. (233,454.)

4,445. "Electrical switch fuses." Midland Electric Manufacturing Co., Ltd., and W. L. Barber. February 21st, 1924. (233,460.)

4,630. "Aerials or lead-in members for wireless telegraphy and telephony." A. E. Johnson. February 22nd, 1924. (Cognate application 28,108/24.) (233,465.)

4,889. "Automatic or semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., J. E. Collyer, and C. W. Willman. February 26th, 1924. (233,467.)

4,958. "Safety electric lighting fitting." H. P. Blake. February 27th, 1924. (233,468.)

5,944. "Wireless aerials." H. Ashton. March 8th, 1924. (233,477.)

6,845. "Crystal rectifiers or detectors." P. G. Handoll. March 17th, 1924. (233,489.)

8,472. "Combined gramophonic and telephonic sound-reproducing means." E. A. Graham. April 3rd, 1924. (233,495.)

8,889. "Method and apparatus for use in electric resistance welding, sheet-metal articles, and the like." C. Schaer. April 30th, 1923. (215,329.)

9,106. "Suspension globes or the like, and lamps of electric light fittings." Smith & Ansell, Ltd., B. Ansell, and N. Smith. April 10th, 1924. (233,500.)

9,979. "Method of manufacturing tungsten wires suitable for use as electric incandescing bodies." General Electric Co., Ltd. April 21st, 1923. (214,662.)

10,644. "Variable electrical resistance." British L.M. Ericsson Manufacturing Co., Ltd., W. D. Norbury, and F. Bates. April 30th, 1924. (233,513.)

11,226. "Multiple-unit electric train controls." W. S. Graff-Baker. May 6th, 1924. (233,516.)

12,470. "Containers or boxes for thermionic valves, incandescent electric lamps, and the like." W. Elliott. May 21st, 1924. (233,526.)

12,514. "Electric furnaces." Soc. Italiana E. Breda. May 28th, 1923. (216,864.)

12,600. "Boxes or containers for electrical accumulators." W. R. Edwards. May 22nd, 1924. (233,528.)

13,241. "Apparatus for medical treatment with high-frequency electric currents." W. Otto. June 6th, 1923. (217,213.)

14,059. "Combination electric battery and condenser." H. R. Van Deventer. June 14th, 1923. (217,586.)

15,841. "Accumulator grid plates." H. Keller. January 10th, 1924. (227,411.)

16,037. "Method and apparatus for making a durable dielectric connection at the soldered joints and repaired places of electric conductors insulated with gutta-percha or the like." Norddeutsche Seekabel-Werke Akt. Ges. July 4th, 1923. (218,667.)

16,298. "Electrically-operated percussive tools." D. H. Lamar. July 7th, 1924. (233,557.)

16,706. "Telephone attachments for phonographs and the like." Dubilier Condenser Co. (1921), Ltd. (formerly Dubilier Condenser Co., Ltd.) (H. R. van Deventer). July 11th, 1924. (233,563.)

16,970. "Crystal detectors for wireless telegraphy and telephony." H. L. Rosenthal. July 15th, 1924. (233,564.)

18,350. "Electrical conductors." Dr. H. Glaser. July 31st, 1924. (233,571.)

19,999. "Electric switchgear for use on motor road vehicles." Luma-Werke Akt. Ges. August 25th, 1923. (220,962.)

20,256. "Crystal detectors used in connection with wireless apparatus." N. Hall. August 27th, 1924. (233,578.)

20,473. "Train-lighting systems." P. H. M. Breuer. August 29th, 1924. (233,579.)

20,747. "Thermal or pressure-operated electric switches." J. L. H. Guidet. September 5th, 1923. (221,504.)

20,772. "Carrier wave working over high-tension lines." Western Electric Co., Ltd. September 22nd, 1923. (222,104.)

25,180. "Electric heating apparatus." Dr. P. Eversheim. December 24th, 1923. (226,781.)

25,880. "Electrodes used in electrolytic systems for the prevention of corrosion in condensers, boilers, or the like." A. Kirkaldy. October 30th, 1923. (224,238.)

26,175. "Electric thermic time-limit relays." Allmanna Svenska Elektriska Aktiebolaget. December 10th, 1923. (226,171.)

26,495. "Sparking control devices for explosion engines." M. Dutes. December 4th, 1923. (225,831.)

27,797. "Illuminated signs." L. E. R. Murray. November 20th, 1924. (233,612.)

29,038. "Machines for making filament supports for electric lamps and the like." Naamlooze Vennootschap Philips Gloeilampenfabriken. December 5th, 1923. (225,855.)

1925.

534. "Vacuum electric tube devices." Westinghouse Electric & Manufacturing Co. January 8th, 1924. (227,451.)

830. "Telephone systems." Western Electric Co., Ltd. (Western Electric Co. Inc.). November 6th, 1923. (Divided application on 230,377.) (233,629.)

1,400. "Apparatus for translating pressure variations into electrical variations." Westinghouse Electric & Manufacturing Co. January 25th, 1924. (Addition to 207,182. (228,156.)

3,015. "Resilient gear-drive for electric sewing machines." Singer Manufacturing Co. April 24th, 1924. (232,933.)

6,430. "Telephone lines." Siemens & Halske Akt. Ges. March 10th, 1924. (230,495.)

7,805. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. January 1st, 1924. (Cognate application 7,806/25.) (Divided application on 233,007.) (233,643.)

7,811. "Searchlight projector for closed vehicles." Aero Motor-U. Auto Zubehör Akt. Ges. August 9th, 1924. (233,644.)